FEMALE COMBAT HELICOPTER PILOT SELECTION CRITERIA

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MASTER OF MILITARY ART AND SCIENCE

by

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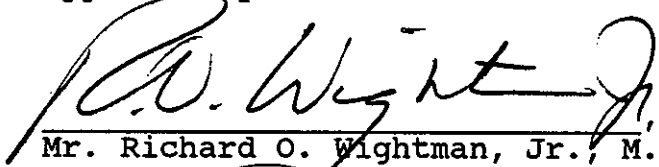

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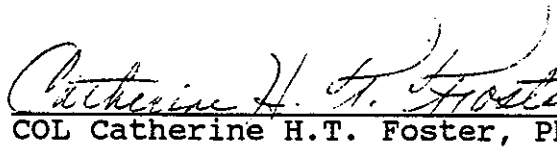

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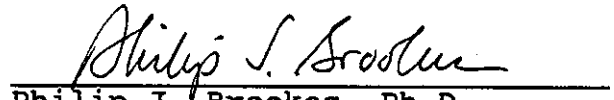

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

FEMALE COMBAT HELICOPTER PILOT SELECTION CRITERIA by
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This study investigates selection criteria for selecting female aviators for training in combat helicopters (AH-64, AH-1, OH-58D, and RAH-66). Selection for such training would occur as either a part of the multi-track program of instruction used in the current Initial Entry Rotary Wing flight training course, or as transition training for already qualified aviators.

Analysis included a review of: current Army Regulations governing prerequisites for combat helicopter training and combat helicopter maintenance test pilot training; Initial Entry Rotary Wing selection criteria for combat helicopter tracks (AH-1 and OH-58); Aviation Branch Personnel Manager interviews; Combat Helicopter Manprint/Anthropometric restrictions; Standards of medical fitness; Anthropometric standards; and previous reports on female performance in Initial Entry Rotary Wing training.

Conclusion supports selecting females for combat helicopter training using the same selection criteria currently used for choosing males for such training.

Study recommends additional research in aircraft accommodation measurements; social-psychological aspects; and physical body strength requirements.

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LIST OF ABBREVIATIONS

ACCE	Aircrew/Cockpit Compatibility Evaluation
AF	Air Force
AGARD	Advisory Group for Aerospace Research and Development(Organization Du Traite De L'Atlantique Nord)
AH-1	Cobra Attack Helicopter
AH-64	Apache Attack Helicopter
AR	Army Regulation
ARI	Army Research Institute
ASI	Additional Skill Identifier
CH'KRIDE	Checkride
CF	Canadian Forces
DA	Department of the Army
DA Form 4187	"Personnel Action" form
DAC	Department of the Army Civilian
DACOWITS	Defense Advisory Committee on Women and the Services
DCPC	Direct Combat Probability Coding (system)
DOD	Department of Defense
FAST	Flight Aptitude Selection Test
GT	General Technical (Test)
HQDA	Headquarters, Department of the Army
IERW	Initial Entry Rotary Wing
IP	Instructor Pilot

IPC	Instructor Pilot Course
MOI	Method of Instruction
MOS	Military Occupational Specialty
MTOE	Modified Table of Organization and Equipment
MTP	Maintenance Test Pilot
NVG	Night Vision Goggle
OCS	Officer Candidate School
OH-58DI	Kiowa Warrior Improved Scout Helicopter
PERSCOM	United States Total Army Personnel Command
POW	Prisoner of War
PSC	Personnel Service Company/Center
PT	Physical Test
RAF	Royal Air Force
RAH-66	Comanche Attack Helicopter
ROTC	Reserve Officer Training Corps
SI	Skill Identifier
SQI	Special Qualification Identifier TOW, Tube-launched, optically tracked, wire-guided (missile)
USAAMC	United States Army Aviation medical Center
USAAVNC	United States Army Aviation Center
USMA	United States Military Academy
USC	United States Code
WAC	Women's Army Corps
WOCD	Warrant Officer Candidate Development (course)

CHAPTER 1

INTRODUCTION

Thursday, the 29th of April 1993, Defense Secretary Les Aspin issued a directive to order the armed services to let women fly aircraft in combat. This directive represents the final step on the long-standing debate on how to utilize women in today's armed forces. Actions leading to Aspin's directive were shaped by women's recent impact on armed forces history.

On 5 December 1991, Congress influenced by the coverage of servicewomen in the Persian Gulf conflict, repealed a 1948 law that prohibited women from flying aircraft with combat missions. This law, the Department of Defense (DOD) Authorization Act of 1992, was codified at Title 10 United States Code (USC), Sections 6015 and 8549 (Appendix B) and was applicable only to Air Force and Naval servicewomen. The Army was excluded from the law because Army policy, not legislation, has kept servicewomen out of combat aircraft.

Army policy on the assignment of women in combat aircraft is founded on two principles: the difference between combat and direct combat, and the DOD Risk Rule.

These are the principles that prohibit Army servicewomen from serving in positions that involve direct combat roles.

These principles are stated in the Army's regulation on assignment policies for female soldiers, Army Regulation (AR) 600-13. The guidance in AR 600-13 allows women to serve in any specialty or position except in those specialties, positions, or units (battalion size or smaller) assigned a routine mission to engage in direct combat or routinely collocate with units assigned a direct combat mission. This Army policy is implemented through the Direct Combat Probability Coding System (DCPC). DCPC codes specialties, positions, or units closed to women due to the combat risk involved as determined by the DOD Risk Rule. Approved by the Secretary of Defense in February 1988, the Risk Rule states:

> The risk of direct combat, exposure to hostile fire or capture are proper criteria for closing positions to women. If the type, degree, and, to a lesser extent, duration of risk are equal to or greater than direct combat units (infantry/armor), then units or positions may be closed to women.[1]

This policy is general in nature and defines risk in terms of direct combat, exposure to hostile fire, or capture but it does not qualify direct combat. AR 600-13 describes direct combat as:

> Engaging an enemy with individual or crew served weapons while being exposed to direct enemy fire, a high probability of direct physical contact with the enemy's personnel and a substantial risk of capture. Direct

> combat takes place while closing with the enemy by fire, maneuver, and shock effect in order to destroy or capture the enemy, or while repelling the enemy's assault by fire, close combat, or counterattack[2]

Thus DCPC is used to determine if a position is open or closed to women based upon the duties of the job, unit mission, battlefield location, and Army tactical doctrine. Positions determined to be closed to women are coded P1, due to their high degree of risk. All other positions are coded P2, indicating they are non-gender specific.

While it may appear relatively simple to apply the four criteria of the DCPC to determine which Army aviation positions should be coded P1 or P2, recent utilization of women aviators in Operation Just Cause (1989-90) and in Operation Desert Storm (1991) compounds the application of these criteria. In both of these combat operations, women flew unarmed aircraft into hostile areas under fire, in front of the combat aircraft, and/or worked side-by-side with combat aircraft flown by their male counterparts. In simpler words, where the women aviators operated from and flew were not any safer or more dangerous than what the men flew.

The missions of both lift and utility helicopters require their crews to operate within the zone of direct combat. While this utilization does not violate the definition of direct combat, it does suggest that if women are in aviation, even in the utility or lift missions, there

is no guarantee on the modern battlefield that they will operate in a combat-free environment. So how do you code positions that may require exposure to direct combat?

The Army policy that kept women out of combat aircraft was based upon conventional social and military thoughts concerning women in combat. But the large presence and satisfactory performance of military women in the 1990-91 Persian Gulf crisis challenged these conventional attitudes. In an effort to further examine the crucial social and military issue of women in combat, the DOD Authorization Act of 1992, created a presidentially appointed commission to study the assignment of women in the Armed Forces. The commission's assessed the laws and policies regarding the assignment of women and made assignment recommendations to the President in November 1992. The commission recommended the current Army policy reference the assignment of women to combat aircraft be retained, as well as codification of Army policy consistent with the policies of the other Services. Unfortunately the validity of the commission's findings are questionable due to rumors of a very divided and adversarial membership which included "a walk-out by five conservative members and passionate personal attacks by commissioners accusing each other of bad faith, close-mindedness, and even religious heresy...."[3]

The completed 121-page report was forwarded to Congress by then President Bush, as required by law, without any

comments. The Chairwoman of the Defense Advisory Committee on Women and the Services (DACOWITS) asked the Secretary of Defense to repudiate the commission's report (December 1992). Practical utilization of women in the Army as demonstrated in Operations Just Cause (Panama) and Operations Desert Shield/Storm (Persian Gulf) tended to side with DACOWITS' opinion that Service policies, not legislation, should make the decisions on how best to use its available human resources.

The recommendations of the Presidential Commission on the Utilization Of Women In The Armed Forces, the lobbying efforts of DACOWITS, DOD policy, and Army policy all address the issue of women in combat aircraft. Since the Army enjoys a progressive reputation with respect to its policies regarding the utilization of women, it is probable that Aviation Branch will lead the way in dropping gender restrictions against assignments in combat aircraft, helicopters specifically. For this form of combat is highly technical, which is very different from hand-to-hand fighting.

The current political trend to downsize the American military, implies soldiers will have to become more versatile in order for the Services to retain capabilities with few resources. Pilots are a resource for the cockpit. Within the Army's helicopter inventory, approximately 43 percent of the helicopters are classified as combat

helicopters. Within population resource constraints, the larger the population pool eligible for selection as combat helicopter pilots, the greater the probability of selecting those with the best potential for service as combat pilots. Thus by deleting gender restrictions against pilot selection the Army will be able to keep the available selection population pool as large as possible.

Now that the Secretary of Defense has issued a directive allowing women to fly combat aircraft, the next question to be answered before servicewomen actually get into the cockpits of the Army's combat helicopters for training, is how does the Army select servicewomen to fly these helicopters. The focus of this paper is to determine the servicewomen (female officers) selection criteria for combat helicopters. This study will analyze the current Army combat helicopter training selection program used for male officers for applicability in the selection of female officers into combat helicopters as well. Army combat helicopters include the Apache (AH-64), Comanche (RAH-66), Cobra (AH-1), and Kiowa Warrior (OH-58DI) aircraft. All of these helicopters are sufficiently armed to assume an offensive fire support role and/or engage in direct combat as defined by AR 600-13.

Current Combat Helicopter Selection Procedures

There are two ways for an aviation officer to be selected for training in combat helicopters. The first method is to be selected for a combat helicopter transition while in flight school. The second method is to submit a personnel action request for training in a specific combat helicopter to the Aviation Branch Program Manager who selects officers for combat helicopter training based upon unit/duty assignment requirements. Details on both processes are addressed in detail later in this study.

Objectives

This paper will determine female combat helicopter pilot training selection criteria. The female officers/ aviators to be considered for combat helicopter training will already be qualified for, or have completed, the Army's Initial Entry Rotary Wing (IERW) qualification course.

Scope

Statement of the Problem

Can current combat helicopter pilot training selection criteria can be expanded to include female officer/aviator applicants?

Statement of the Subproblems

A. What are the current combat helicopter selection criteria applied to male officers attending IERW?

B. What are the current combat helicopter selection criteria applied to male officers/aviators who have completed IERW?

C. What are the anthropometric limitations for combat helicopters that may limit female officer/aviator selection?

D. What are the current selection criteria for female combat helicopter maintenance test pilots?

E. Are the current Army combat helicopter selection program eligibility requirements changed when expanded to include both male and female officers/aviators?

Hypothesis

The selection criteria in the Army's current combat helicopter pilot selection programs will not need modification when the eligible pilot population is expanded to include both male and female aviators.

Delimitations

This study will not address selection of female officers for aviation duty but only those female officers/aviators who are already qualified for aviation duty. Additionally, this study will not differentiate between female warrant officers and commissioned officers.

Assumptions

The Department of Army policy on the assignment of women into combat helicopters will change. The change in policy will allow Army Aviation to assign female pilots to combat helicopters.

Significance of the Study

The definition of what is or what is not combat is difficult to clearly articulate in both theory and practice. Women fly air assault missions under enemy direct fire to insert TOW teams, yet they cannot fly attack aircraft. Attack aircraft that can stand-off and fire at a hostile target out of range of the target's individual direct fire weapons. Thus regardless of the best intentions of past leaders, women are going to be at risk of exposure to enemy action when flying either attack or non-attack aircraft on the modern battlefield. Despite those people that may not want to accept such a risk for its women soldiers, the national public opinion polls indicate that United States citizens are very proud of their women astronauts who take great risks, as the tragedy of the space shuttle Challenger demonstrated.[4]

Military support of equal opportunity legislation has increased the job opportunities for women over the past decade. With these new jobs comes an equal share of risks

as well. As the Assistant Secretary of Defense for Manpower declared in 1984:

> Women have not been allowed into the military to fill peacetime needs. They are in the military to stay.... The laws that exclude women from being assigned to direct combat roles do not guarantee that women will not become casualties.[5]

In 1988, the Secretary of Defense reemphasized DOD policy concerning women soldiers:

> The women will remain with their units and continue to do the same job in wartime that they are doing today. There will be no plans or instructions to remove or evacuate them.[6]

Women soldiers, like their male counterparts, are very proud of their contributions as soldiers. Focusing on the women officers who serve in Army aviation, their past and present performance indicates they are just as proficient as male pilots, if not superior in some areas. They generally work harder at being professional because they know they are being scrutinized. They continue to demonstrate good leadership capabilities within the same proportions as men. Thus it is logical that many of these women want to have the opportunity to serve in all aviation positions, to include those that are closed to them because the aircraft qualifications coded for that duty position include a combat aircraft. They can fly an assault mission into a hostile drop zone, but not fly the combat aircraft that might cover their landing into such an area. These women do not like

feeling like "half-pilots," and want to share the workload equally.

Army Aviation Branch and United States Army Aviation Center (USAAVNC) are progressive and forward looking. In preparation for possibly being asked to take the lead in opening combat aircraft to women. USAAVNC requires accurate selection criteria. Those first few women to fly combat aircraft will be closely watched by the entire military and civilian community. So it is important to properly select these women so true performance capabilities are evaluated. Additionally, it is important to determine if there are any cockpit design requirements presently used in the utility and lift cockpits for a non-gender specific pilot that apply to combat aircraft. The combat aircraft cockpit designs have only needed to support the typical male-pilot manprint and may not be safe for women, due to their anthropometric structure, to fly.

Thus, this thesis is intended to assist in Army aviation's continuing effort to improve the efficiency of the selection and training of Army combat aviators. A necessary quest in order to ensure Aviation keeps the "Best above the Best."

CHAPTER 2

REVIEW OF RELATED LITERATURE

> The idea of the military is to make war. The fact that we are saving all these jobs for women means that [men] have a greater chance of going to war. We pay these guys for two things: one is the job they do, the other is the risk they take. And they are getting the same pay but taking more of the risk. If I were a man, I would really object to that.[7]
>
> Army Major Rhonda Cornum, MD, former POW, 8 July 1991, speaking in Washington, D.C.

The research for this paper did not uncover any significant studies on mental and emotional aptitudes of women which affect their ability to tolerate the stresses of an aviation environment. While cognitive performance and good judgement are critical characteristics of successful pilots, the ability of current selection/evaluation tests to predict these attributes in either males or females has yet to be demonstrated.[8] Thus, this paper's literature review is restricted to anthropometric, physical, and medical aspects as applicable.

With the institution of the All-Volunteer force and the integration of the Woman's Army Corps (WAC) into the Regular Army in the mid-1970s, the number of women in the

Armed Forces has steadily increased. A fiscal year (FY) 92 consensus of total Army strength by the Office of the Deputy Chief of Staff for Personnel recorded that the Regular Army is 11.8 percent female and continuing to increase. These service women occupy a wide variety of military occupational specialties. Although the presence of women serving in various wars throughout our history can be recounted, it is the conflicts of the volunteer force (Grenada, Panama, Southwest Asia, and Somalia) that challenges society's view on women in combat and or hostile situations. Women pilots in the today's volunteer military force continue to demonstrate the aptitude and attitude to be successful aviators.

Arguments as to the woman's capability to endure and perform as a professional soldier have slowly withered in the past 50 years. In 1948, Senator Margaret Chase Smith argued in Congress for the integration of servicewomen into permanent positions in both the regular and reserve forces.[9] Although Smith was successful in her argument, many constraints on the use of servicewomen were imposed. The most significant of these constraints was a 2 percent ceiling on the proportion of women in the services, a prohibition against flag rank (General/Admiral status), and the statutes and service policies limiting the roles of women to non-combat positions.

Today women are trained in the Reserve Officers Training Corps and at the military academies. Women officers have also achieved flag rank. Only the prohibitions against serving in positions with a significant risk of direct combat restrict the utilization of women in the Army.

During Operation Urgent Fury when units were deployed into Grenada in the early 1980's, women soldiers were initially denied the right to deploy with the units they were assigned. Eventually over 160 served in this Operation. In 1989, the United States Armed Forces conducted Operation Just Cause. This time women soldiers deployed and fought with their assigned units. Although most of the media attention focused on the actions of a female Military Police officer, the first women in assault helicopter crews proved their mettle by inserting and extracting troops under direct small arms fire (direct combat). Operation Desert Storm had numerous female aviators flying noncombat helicopters throughout the battlefield. This included conditions supporting the definition of direct combat in their support of ground troops. These actions collectively challenge the question of women in combat helicopters.

There are numerous studies addressing the issue of women in combat and women in military aviation. The U.S. Army's Research Institute for the Behavioral and Social

Sciences in January 1982, published a collection of seven working papers under the title "The Utilization of Women in Combat: An Historical and Social Analysis of Twentieth-Century Wartime and Peacetime Experience," addressing the utilization of women in combat and areas related to combat. The research described the use of women in Russia/Soviet Union, Yugoslavia, Germany, Britain, Israel, Sweden, and Denmark. The study provides excellent information on how and in what capacity women have performed in the services and in combat, in the recent past. Historical evidence indicates women were trained on a small scale for combat. These women saw battlefield action in infantry, armor, artillery, and aviation roles. Additionally the study reports problems with women performing battlefield tasks requiring upper body strength, yet the studies indicating such problems did not record the relief of women from these strenuous tasks, only that the women had to find a different way to perform these physical tasks.[10] While their contributions were significant, social norms of the pre-volunteer Armed Forces favored the use of women in combat as a last resort and only in defensive operations.

A recent study (1992), "USAF Women Pilots - The Combat Issue," by Air Force Major Teresa Marne' Peterson, a pilot with over 1500 flight hours, concluded that women have the physical and mental abilities, and emotional stability to fly combat aircraft. However, the policies and laws

continue to prohibit women from performing in a combat role.[11]

Not waiting for the United States to take the lead on the issue of servicewomen utilization in the combat cockpit, Great Britain recently announced its intention to open fighter pilot slots to women. The Netherlands, Canada, and Sweden already have lifted the gender barrier in combat aircraft assignments years ago.[12]

When Great Britain's Royal Air Force (RAF) decided to open cockpits to women, they discovered very little data on the distribution of critical body dimensions for the British female population. The RAF decided to use American female pilot anthropometric data to predict the effects of minimum RAF anthropometric selection limits on their female population. Specific questions raised in the RAF's initial study to identify potential problems concerned limb strength related to aircraft controls, a minimum weight for ejection seat occupants, and specific aircraft anthropometric limitations.[13]

To counter concerns over physiological issues, the RAF required potential female pilots to meet present RAF aircrew entry limits. Table 1, Appendix C, demonstrates the proportion of the female population potentially excluded by RAF aircrew minimum entry limits. Cumulatively, it is reasonable to conclude that slightly over one-half of the

female population will be excluded from aircrew selection because of their small stature.

The RAF study concluded recommended additional investigation of the anthropometric limitations for individual aircraft at the lower end of the aircrew entry standards. This study should include strength in order to determine if males and females, for example, with the same leg length also possess the same leg strength.[14]

In 1976, the Netherlands opened almost all military positions to women. Within the Royal Netherlands Air Force, this included positions in helicopters, transport, and jet aircraft. Using an extensive selection process for aviator candidates, the Royal Netherlands Air Force in 1982, selected the first female helicopter pilot candidate for the Royal Netherlands Air Force. The aviator selection process used by the Dutch was not altered in any way for female candidates.[15] This selection procedure and the training program outline are at Tables 3 and 4 in Appendix D.

In general, the Royal Netherlands Air Force learned from the initial selection of women in 1982, to the present, that as the number of women continues to increase, the problems associated with them as tokens will decrease. They learned that it worked best for the initial women if they went through flight training in a group of at least three. Not only were women supportive of each other, but attention of those concerned with the women's initial performance was

focused not on an individual, but on the group. The group arrangement made it easier for the women to withstand the experience, and made observations for generalization toward the female population as a whole, much more accurate. In the words of one aviator, when introducing women into a new field it is best to just pick them and then leave them alone. Avoid press coverage, do not make them the center of attention, no extra privileges, just let them do their job.[16]

In the Canadian Air Force, women have been members of aircrews since 1979. Data collected since the introduction of women, indicates women were less successful than men in selective competition for aircrew training. The female applicants demonstrated difficulty in tests evaluating quantitative and spatial/psychomotor skills and in meeting medical standards in anthropometry. The failure to meet anthropometric standards (Table 4, Appendix E) will continue to be a problem for the Canadians as long as their military cockpits are designed primarily for the male anthropometric standard. But those women that did get selected performed no differently than their male counterparts in achieving aviator standards.[17]

The Canadian concern over the physical incompatibilities between aviators and their cockpits in terms of safety and mission success is admirable. In an effort to avoid physical incompatibilities between pilots and crew stations, the Canadian Forces (CF) select pilot candidates

based upon a recruiting policy of universal assignability. The pilot candidates selected, male and female, must be able to operate any Canadian aircraft. In theory these standards should be based upon the anthropometric limitations imposed by actual crew stations. In practice, the Canadian's found fitting the pilot to the aircraft is more difficult than anticipated because selection standards have evolved from "... (1) aircraft design recommendations, which bear little relationship to the finished product, or (2) anthropometry of existing aircrew, which ignores the issue."[18]

To increase the effectiveness of their pilot selection process, the CF commenced a detailed study known as the Aircrew/Cockpit Compatibility Evaluation (ACCE). This study used a computer simulation to test various anthropometric body types for cockpit compatibility. It assumed a human anthropometry in order to eliminate any gender, race, or nationality bias. The results of the ACCE should restructure CF selection standards to support specific aircraft anthropometric limitations. The danger in enforcement of a universal selection standard based upon a cummulation of aircraft limitations is a restricted number of pilots selected. Enforcement of aircraft-specific limitations could force policies where a pilot's career is limited to specific aircraft assignments which could force a segregation of the pilot population.

The ACCE used the anthropometric dimensions of sitting height, seated eye height, seated acromion height, biacromial breath, forward functional reach, buttock-knee length, and seated knee height to map the physical relationship between anthropometry and crew station geometry. Accommodation assessments were made on aircraft requirements for head clearance, vision, leg reach and clearance. Arm reach was not considered because the most important set of arm reach targets couldn't be chosen. The study noted arm reach is important and requires further study to determine selection criteria.

The current CF anthropometric selection criteria when applied to United States Air Force anthropometric data for male and female populations yielded acceptance figures of 94 percent for male, and 36 percent for females.[19] The significance of the difference in acceptance between the gender groups does not correct for bias based upon the fact that the male population had been anthropometrically pre-screened, and the female population had not.[20]

The ACCE studied all the CF aircraft for accommodation. The CF CH136 helicopter is the Canadian import of the American OH-58, Kiowa helicopter. In the CH136, gender related incompatibility problems were apparent in head clearance and leg accommodation. Females fit better than males for head clearance (99 percent fit versus 54 percent fit), but males have fewer leg accommodation problems (89

percent fit for males, 35 percent fit for females).[21] Vision was not a problem for either gender probably due to the large surface area of the cockpit windows (windscreen). These results conflicted with the current CF selection criteria because many women are rejected on the basis of seated height (60 percent) which affects vision, while only 26 percent are rejected based upon leg accommodation.[22]

The results of the ACCE indicated to the CF that their universal assignability selection criteria are biased against females and small males. The study concluded recommending further compatibility tests using live subjects to validate the anthropometry/crew station relationships identified in the ACCE. Meanwhile, the Canadians continue to recruit both male and female pilots in accordance with the same pilot selection criteria even though there are recognized anthropometric discrepancies.

Besides anthropometry, there are other issues which can influence the combat helicopter selection criteria for women. These issues include physiology (physical), psychological (mental), and emotional composition of females. Recently, the Spanish Air Force studied with detail the question if gender makes any difference in the physical and psychological performance of the pilot at the flight controls.

The Spanish Institute of Aviation Medicine developed a series of tests to see if gender influences performance and

time to perceive, process, and respond to a situation. They tested 135 non-aviator experienced applicants for a commercial pilots license. The gender breakdown of this group was 115 males and 20 females, 17 to 25 years old. The average performance in the total sample was higher for females than males. The female group also demonstrated the presence of a fast "learning factor" for females over males in that the females improved scores to a greater extent than the men. While this test did not consider any other possible physiological or psychological variables which many have influence performance of either gender group, it did not uncover any indications that women cannot perform satisfactorily in the cockpit.[23]

The review of related literature about women in military aviation demonstrated only minor differences between the genders. These noted gender differences in work performance disappeared when the variables of size, strength, and fitness were considered.[24] The following paragraphs will briefly address these gender differences in anatomy, size, fitness, and strength relevant to performance in the cockpit.

Anatomically, the differences in overall body composition and breast anatomy impact most significantly on proper equipment adjustment.[25] Women average seven to ten percent higher body fat composition than their male counterparts. Breast anatomy requires women to carefully

fit equipment, but imposes no aeromedical limitations. For example, for women who fly with a parachute harness, "... the harness can rise from 4 to 8 inches (10 to 20 cm) as a result of compressing the buttocks during opening shock and cause breast injury if the chest strap is adjusted below the breasts."[26] Thus the presence of women indicates a need for individual equipment to adjust to accommodate smaller sizes, which will improve the equipment fit for smaller men as well.

Although anthropometric differences were addressed in earlier paragraphs, basic size and shape differences between the "average" male and female United States Air Force pilot candidates in a 1968 survey indicate female aviation candidates are not representative of the average population. The average female candidate is 64 inches (163 cm) tall, two inches taller than the civilian population average at that time.[27]

The most probable restriction to placing females in the military cockpit is that these cockpits are generally designed to accommodate the average white male, not female, anthropometric limitations. Current United States design standards exclude the smallest 5 percent of the white male population and 50 percent of the white female population.[28] Aircraft cockpits would need to be redesigned to accommodate more white women, an economically costly endeavor. However, as aircraft are redesigned to accommodate a greater

proportion of the female population, the accommodation percentage of the number of members of races smaller than the white/caucasian race will increase as well.

Within the 50 percent of the white female population that does fall within 95 percent of the white male height population, the differences in hips, chest, and hands indicate the issue is not just one of size differences.

> Although the T percentile woman may correspond roughly to the 5th percentile man, she will probably have larger hips and chest depth and smaller hands (75). Female hip circumference is often proportionally larger than torso length or chest girth (72). Women also generally have a shorter arm length than men of the same height.[29]

Anthropometric requirements vary from cockpit to cockpit. The size variances within the human gene pool do not lend themselves to gender specific generalizations. For example, while the chest girth and torso length of women maybe smaller, the women's hip girth may be larger. Men and women of the same height, usually are different in weight, arm length, and center of gravity--all of which are lower for the women.[30] Again, these differences present the greatest challenge to the proper fitting of personal and protective equipment, and aircraft design specifications.

Aerobic fitness is best measured by evaluating maximal oxygen utilization. Men generally have greater absolute aerobic capacities than women. But when maximal oxygen utilization is adjusted for lean body mass, men and women perform almost identically. Aerobically, men can generally

carry a load over a set distance faster than women can carry the same load. But when maximum oxygen utilization is measured and adjusted for lean body mass, differences in performance due to gender disappear.[31] In other words, both men and women worked at the same maximal oxygen utilization percentage. So when performance is adjusted for maximal oxygen utilization, there are no gender differences which affect work performance.

Strength differences between genders is a concern when selecting women for older, less technical aircraft since control inputs in these aircraft have less mechanical assistance than modern aircraft. "The average strength of an adult woman is about two-thirds that of an adult man. Leg strength in women is 71.9 percent that of men and arm strength 55.8 percent that of men (49)."[32] Most women can meet the strength requirements for manipulating one control in an emergency situation. The U.S. Army Aeromedical Research Laboratory studied the ability of subjects to manipulate simultaneously more than one flight control in an emergency situation with reduced-to-no mechanical assistance for flight control manipulation. In this test, approximately 50 percent of the men and 90 percent of the women tested failed to meet required strength levels.[33]

The Aeromedical Research Laboratory's physical test (PT) indicates good reason for concern over strength differences which may have value when considering the

placement of women into older airframes, such as the UH-1H and the AH-1. There are no reports indicating that women who meet current standards routinely have difficulty with reach or strength in an operational setting. Most strength differences are attributed to a man's greater lean body mass.[34] As with aerobic work, allowances for lean body mass abolishes most of the gender differences in lifting and carrying capacity. The use of weight training program by women even further decreases strength differences (corrected for lean body mass) between genders.

But to use PT to measure strength may not be an accurate means of determining if women can handle the necessary physical requirements of cockpit duties. Recent opinions from subject matter experts in the Navy and the Army offer the following comments on strength issues:

> What we found in the Navy about strength issues, while they may have been a problem in certain respects, was that the women worked smarter and the problems went away. When they were going to test postal clerks, they had a 40-lb sack of mail which had to be lifted up and put on a scale that was on the counter top and the guys came in and did it. But the first woman came in and looked at the bags, [and] looked at the scales. She took the scales off the counter and put them on the floor and weighed the bags. That's what we found in our testing. You have to be careful about using a PT test.[35]
>
> Navy Captain Georgia Sadler, 8 July 1991, speaking to Women Officers Professional Association, Washington, D.C.

> The PT Test measure does not measure physical strength for sure. It measures aerobic propensity. And the body fat thing measures how good you look in uniform. So right now I don't think we have any way of measuring strength.[36]
>
> Army Major Rhonda Cornum, MD, former POW, 8 July 1991, speaking to Women Officers Professional Association, Washington, D.C.

The capacity to withstand temperature extremes increases an individual's potential for survival in certain operational settings. Women, with their increased percentage of body fat have been said to have an advantage in tolerating cold water immersion. Studies of Korean divers, an exclusively female profession, in water as cold as 10'C, seems to support this observation.[37] However, not all studies support this observation. When men and women with the same body fat levels are immersed in cold water, the men demonstrated less heat loss, higher oxygen consumption, tended to shiver sooner, and maintained a higher skin temperature. The authors of this study speculated that the increased fat insulation in the extremities of women may explain this difference because the female subjects used in this test were extremely fit women with lean body mass equivalent to men. The study did not compare men with body fat levels similar to women.[38]

The research for this paper did not find any tests indicating any operationally significant gender differences in heat tolerance among acclimatized men and women of

similar fitness. Although one study recorded fit women acclimatizing faster than men in hot environments.[39]

Medically, male aviators are at greater risk for sudden incapacitation due to illness or injury than women aviators. Cardiovascular disease, the greatest cause of disqualification for flight duty among aviators, is double the incidence within the aviation population for men than women. Male pilots statistically demonstrate a higher risk of both fatal and non-fatal aviation accidents as well.[40]

The menstrual cycle exhibited no effect on cockpit performance. During flight training some women experienced menstrual irregularities associated with stress, but there are no recorded studies of pelvic discomfort due to menstruation while performing cockpit duties.

Anatomically as well as physiologically, there are no significant barriers to women in aviation. Overall aerobic fitness predicts one's ability to do prolonged work. Both genders demonstrate the capacity to perform flight duties over extended periods time. Most of the strength and anthropometric issues are being designed away. While women may have some strength and size limitations imposed on them by earlier models of helicopters, the newer helicopters are capable of accommodating a wide variation of body sizes. Due to the high pilot workload in the cockpit, these newer aircraft are not designed with strong pilots as a prerequisite.

The tolerance differences between the genders in susceptibility to hypoxia, heat, and cold tolerance are unlikely to be of operational significance. These small differences between the genders tend to disappear when fitness and body composition are eliminated. Thus for today's aircraft, selection criteria for pilots could address size, strength, and fitness requirements without reference to gender.[41]

In May 1992, two female officers, one from the Navy and one from the Army, published a paper titled "Women In Combat: What Next?" They concluded that female soldiers and sailors are close to witnessing the final evolutionary step to an equal opportunity Armed Forces. Although the inclusion of females into combat units will not be without problems, strong leadership that states a clear, enforceable standard, with its proper rewards is the key to a successful integration. Have one standard of performance for each military occupational specialty and accept into that specialty all who demonstrate the capability to meet that standard.

Various Army Research Institute studies, other reports prepared at the Air Command and Staff College (Air Force), and the Naval Health Research Institute validates the hypothesis that gender makes no difference in piloting an aircraft.[42] In general, there are no differences between male and female pilots as far as professional skills are

concerned. Female pilots and navigators are considered to be just as good as their male counterparts. Those currently serving are superb technicians, excellent aviators, and their professionalism brings them easily into instructor pilot positions.[43] Thus, with identical training, male and female pilots can be expected to perform all flight tasks, both combat and non-combat to set performance standards.

The question "Should women be in combat aviation?" was a political issue favorably resolved by Defense Secretary Aspin, 29 April 1991. With women now allowed into combat aviation, the next step for the Armed Forces is to determine how to select and integrate women into the combat cockpit.

In May 1980, the Army Research Institute concluded an evaluation of women undergoing rotary wing flight training at Fort Rucker, Alabama, titled, "An Evaluation of Minority and Female Performance in Army Rotary Wing Aviation Training." This report evaluated the selection process of minorities and women into Initial Entry Rotary Wing training (IERW). A comparison of women against an equivalent male control group evaluated the following objectives:

a. Determine if female students in IERW performed equivalently to their male counterparts in academic and flight performance grades.

b. Determine if female attrition from IERW differed from their male attrition rates.

c. Identify any differences that evolved in the IERW program of instruction as a result of including female students.

The study found no significant differences in academic and/or flight performance grades for females to include no significant differences in IERW overall grade. As for female attrition or recycles (students set back to another class to repeat a phase of instruction), there were no significant differences between females and males. In addition, there were no ad hoc changes to the IERW program of instruction to accommodate female students. See Appendix E for a detailed summary of this study's findings.

Analysis of 1974-79 academic and flight performance grade trends of female aviators at the USAAVNC, especially during tactical training in the IERW program, supports a prediction for female aviator performance in combat helicopter flight training. Such a prediction indicates that once properly selected, the performance of women in combat helicopters would not be significantly different from male performance. Difficulties with learning the complex combat systems and with gunnery will continue to be an individual, not a gender, issue.

A change in the Army's policy on the utilization of women in combat helicopters will likely change because the deployment and utilization of women in Desert Shield/Desert Storm demonstrated current policies no longer make sense.

The DOD Risk Rule and the Army's DCPC system did not protect or limit the exposure of women to the hazards of combat. Women flew their aircraft in accordance with their assigned mission. Major Marie Rossi led her Chinook (CH-47) company cross the Saudi-Iraqi border when the ground war broke out in support of the 24th Infantry Division's mission without attack helicopter protection. As a UH-1H Company Commander, I led a UH-1H task force of 16 helicopters with the mission of inserting TOW teams in support of the 82d Airborne Division's mission. Twelve women, including Major Rossi, lost their lives during Operation Desert Storm, five as a result of direct combat. Two women during this operation were captured by Iraq as prisoners of war.

In preparation for supporting a change in Army policy regarding the utilization of women in combat, the remainder of this study will focus on providing recommendations on how to best select women for combat helicopter training.

CHAPTER 3

RESEARCH METHODOLOGY

The research methodology to be used to determine combat helicopter selection criteria for female pilots will begin with a review of the current procedures used to select male combat helicopter pilots. A review of these procedures should identify any combat helicopter unique characteristics that the combat pilot should possess for success in training. The selection criteria for maintenance test pilots will also be considered since this duty has not been closed to female pilots. Research will also review medical, physical, anthropometric, and pilot performance studies to identify any recurring themes that may indicate special prerequisites when selecting women for combat helicopter flight training. Finally, the data will be used to justify the formulation of reasonable options for selecting women for combat helicopter training. Each option will be evaluated in accordance with feasibility, acceptability, and suitability criterum.

Data Collection

Data collection will begin with a review of Army regulations to identify:

a. Application procedures for IERW.

b. Application procedures for combat helicopter transitions for flight school graduates.

c. Application procedures for qualification as a combat helicopter maintenance test pilot.

This data will provide the background administrative requirements for helicopter training selection.

A review of the selection criteria used by the United States Army Aviation Center, proponent for all flight training, for selecting male flight school students for transition training into combat helicopters will identify any unique combat-related characteristics essential for combat helicopters pilots.

Interviews of the Aviation Branch Program Managers (both Officer and Warrant Officer) to discover the rational used to determine which male officer/aviator requests for a combat helicopter transition are approved will be considered with the Army regulation data.

The combat helicopter manprint data will be requested from combat helicopter producers. This data will support any anthropometric restrictions to the pilot selection process. A copy of the 1988 Anthropometric Survey of U.S. Personnel: Pilot Summary Statistics, from the United States

Army Natick Research, Development, and Engineering Center, will provide statistical information on pilot structure and allow for validation of the relationship between manprint and pilot physical structure. Manprint and anthropometry may impose limitations on the available selection pool of pilots.

Data Analysis

An analysis of the data collected should identify any gender specific characteristics that would impact on the process of selecting women to fly combat helicopters. The analysis will consist of the data comparison for recurring observations of like elements.

The application procedures for requesting a combat helicopter transition will identify the current combat helicopter selection criteria. By comparing the male pilot selection criteria for combat helicopter transitions against the combat helicopter maintenance test pilot selection criteria for both males and females, gender specific prerequisites for selection should be apparent. It is anticipated that this comparison will not support any gender specific prerequisites for combat helicopter training. It is expected that the primary rationale used by the Aviation Branch Program Managers for approving male combat helicopter transition requests is duty assignment requirements and not pilot skills.

The comparison of combat helicopter manprint data to female pilot anthropometric data, should identify any physical constraints based upon body size that would interfere with a female's capability to fly a combat helicopter. These constraints may require some restrictions on overall height based upon arm and leg length. It is also possible to deiscover some marginal increase in aircraft performance due to lighter crew weight which contributes to an overall lighter operational weight for the helicopter.

Data Synthesis

Synthesis of the results of data will indicate three relevant alternatives. The first alternative is to design a combat helicopter selection program applicable just to female officers/aviators. The second alternative is to integrate female officers/aviators into the current combat helicopter selection program used for male officers/ aviators. The final alternative is to redesign the current combat helicopter selection program, changing some of the selection criteria to increase the number of eligible female officers/aviators.

The three alternatives will be evaluated against the criteria of: feasibility--can it be done, acceptability--will it work, and suitability--is it the best solution available. The best alternative will be used to test this study's hypothesis for validity.

CHAPTER 4

ANALYSIS

A. Review of ARMY Regulations

Application Procedures for IERW

Approximately 85 percent of the commissioned officers are accessed by HQDA from Reserve Officers Training Corps (ROTC), United States Military Academy (USMA), Officer Candidate School (OCS), or direct appointment. The remaining 15 percent are accessed by selecting the best qualified Army flight training applicants in accordance with the application procedures in AR 611-110 (DA Pam 600-3). These applicants are selected by a scheduled HQDA board. ROTC, USMA, and OCS candidates request an aviation specialty on DA Form 4370-R (Preference Statement for Specialty, Duty, and Initial Training. All other applicants apply for aviation training by preparing a DA Form 4187 (Personnel Action). Both forms verify applicants meet medical and Flight Aptitude Selection Test (FAST) standards (AR 611-110). Students are first selected for IERW. While in IERW, students are again boarded by representatives from USAAVNC and PERSCOM for selection to a specialized aircraft track. the two combat tracks are the OH-58 and AH-1 Tracks.

Selection criteria for these tracks include consideration of Aviation assignments needs, student's flight school performance, and student preference. Track information as published in DA Pam 351-4:

OH-58 IERW TRACK

Course Title: Initial Entry Rotary Wing Aviator OH-58 Track.

Prerequisite: Successful completion of IERW Aviator common core.

Special Information: This track is closed to women in accordance with (IAW) AR 611-101 and AR 611-112.

AH-1 IERW TRACK

Course Title: Initial Entry Rotary Wing Aviator AH-1 Track.

Prerequisite: Successful completion of IERW Aviator common core.

Special Information: This track is closed to women in accordance with (IAW) AR 611-101 and AR 611-112.

IERW

Course Title: Initial Entry Rotary Wing Aviator (Common Core).

Prerequisite: Officer, warrant officer, or warrant officer candidate that meets the medical requirements of AR 40-501, and the requirements of AR 611-85 or AR 611-110, as applicable. These regulations state application requirements. Only in the determination of medical fitness are officer candidates required to meet certain fitness prerequisites that are gender specific.

Special Information: This (course) is a prerequisite for follow-on tracks.

Application Procedures for Combat Helicopter Transitions for Flight School Graduates

Aviators can be assessed into combat helicopters by PERSCOM based upon the needs of the Army and consideration of individual assignment preferences. Selection criteria for combat helicopter qualification is indicated in the following paragraphs (Reference: DA Pam 351-4).

OH-58D AQC

Course Title: OH-58D Warrior Aviator Qualification.

Prerequisite: Active Army commissioned officer, warrant officer, or DAC rotary-wing aviator. May be

current in any Army helicopter but must be a graduate of the USAAVNC Scout Track IERW or OH-58A/C MOI/IPC/NVG Aeroscout programs or have aeroscout MOS designator. Assigned or on orders to a unit equipped with OH-58D Warrior helicopters. Must be night vision device qualified. Possess a current Class II flight physical, and must have completed an instrument evaluation within the past 12 months that will not expire during the course. Have in possession DA Forms 2 and 759 and SF 88.

Special Information: SI/MOS closed to women. Students who wear prescription eyeglasses should possess laser prescription eyeglasses.

AH-1 AQC

Course Title: AH-1F Aviator Qualification.

Prerequisite: Active Army commissioned officer, warrant officer, or DAC rotary-wing aviators not previously qualified in AH-1 (PROD), E(ECAS), or F(FM) helicopter. Assigned or on orders to a unit equipped with AH-1F helicopters. Must be night vision device qualified. Possess a current flight physical, and instrument rating which will not expire during the course. Have in possession DA Forms 2 and 759 and SF 88.

Special Information: None listed.

AH-64 AQC

Course Title: AH-64 Aviator Qualification.

Prerequisite: Active Army commissioned officer, warrant officer, or DAC rotary-wing aviators. Qualified and current as an Army aviator IAW AR 95-1. Possess a current flight physical, and instrument rating which will not expire during the course. Must be nap-of-the-earth qualified. Assigned or on orders to a unit equipped with AH-64 helicopters. Must be night vision device qualified. Have in possession DA Forms 2 and 759 and SF 88.

Special Information: Students must report to USAAVNC two days prior to class start date to be fitted for the Integrated Helmet and Display Sighting System.

RAH-66

There is no qualification course for the RAH-66 (Comanche). This helicopter is programmed for fielding in 1997.

The OH-58D qualification course specifically states closed to women in the course requirements. Although the

AH-1 and AH-64 qualification courses don't specifically state they are closed to women, they do require an individual be on orders to an AH-1/AH-64 assignment. The current Army position classification system, DCPC, based upon the DOD Risk Rule codes AH-1/AH-64 pilot positions as DCPC Code P1-closed to women. The only DCPC Code P2 positions for these aircraft are the maintenance officer positions.

AR 611-101, restricts female commissioned aviators from attack helicopter (AH-1, and AH-64) ASIs. Female aviators may qualify in these aircraft to serve as maintenance officers. AR 611-112, similarly restricts female warrant officers, permitting them to fly these aircraft only in maintenance officer positions.

Application Procedures for Qualification as a Combat Helicopter Maintenance Test Pilot

All combat helicopter maintenance test pilot (MTP) courses (AH-1F, AH-64, and OH-58D) have the following prerequisites and special information in common:

Prerequisite: Courses are open to Active Army and Reserve Component commissioned and warrant officers, DA civilians and civilian contractor personnel. These aviators must be qualified and current in the applicable aircraft. They must also have a current

flight physical which will not expire during the duration of the course.

Special Information: Students accepted into thses courses must have flight status orders, flight records (DA Fm 759), flight physical (SF 88), and all necessary flight equipment.

In accordance with current Army regulations, selection procedures for combat helicopter training depend upon the candidate's qualifications. Has the candidate completed IERW or not? If the candidate has completed IERW, selection for combat helicopter training is dependent upon the needs of the Army provided the candidate is fit for flight duty. Initial qualification requires the candidate be on orders for a unit equipped with combat helicopters, or assigned to such a unit.

For AH-1 and AH-64 aircraft, gender restrictions are encountered only through application of DCPC to positions on the unit authorization document (MTOE). The MTP position for these aircraft are DCPC Code P2, thus open to men and women. Today, should the needs of the Army require a female officer to be assigned to an AH-1 or AH-64 unit as a MTP, she could attend the initial qualification courses for these aircraft. The selection criteria used by PERSCOM to slot her in this position are no different than the criteria used to select a male officer for this position. Only the OH-58D

initial qualification course specifically states it is closed to women.

Candidates for combat helicopter training as a part of the IERW tracks are selected by USAAVNC in consultation with PERSCOM which provides Army needs. This selection process is unique to IERW and is addressed in the following section.

B. Review of IERW Selection Criteria for Combat Helicopter Tracks (AH-1 AND OH-58)

Students in IERW are selected for advanced aircraft tracks based upon their ranking on a specially designed Algorithm Test. This complex, computerized test evaluates a student's personality, IERW core curriculm academic and flight performance, IP recommendations, student preference, anthropometric measure for sitting height, mechanical aptitude, eye-hand coordination, and logic.

The results of the Algorithm Tests are objective based upon data input. The ranking by aircraft type of the students is further reviewed, subjectively this time, in order to consider the needs of the Army, any previous flight experience, and to disregard any female students recommended for OH-58 or AH-1 tracks as these tracks are closed to females. (Gender bias has been eliminated from the Algorithm Test.)

ALGORITHM TEST PROCEDURE:

Within the first ten days of IERW, all students take part one of the four-hour, computerized Algorithm Test. This test is actually a battery of tests. A detailed listing of these tests is included in Appendix H. The test results from part one along with each student's anthropometric sitting height measurement is recorded and stored for approximately three months. Sitting height is the only anthropometric restriction tracked among the Algorithm test because students with a sitting height greater than 95cm are too tall for the OH-58 airframe.

Between the 90th and 95th IERW core curriculum training day, the second part of the Algorithm Test data is recorded for each student. Data in the second part includes the student's academic and flight performance grades, class standing, student's aircraft preferences, the student's Primary Phase Instructor Pilot recommendation, and the student's Instrument Phase Instructor Pilot recommendation. The Algorthim is then run. Results are subjectively reviewed for concurrences with previous flight experience and Army assignment needs, while any female students recommended for OH-58 or AH-1 tracks are disregarded.

C. Aviation Branch Program Manager Interview

The Aviation Branch Program Managers (in PERSCOM) control the selection of candidates available for combat helicopter training based upon Army Aviation assignment needs. Commissioned officers and warrant officers are managed separately. The interviews were conducted telephonically using the following questions:

(1) Do you select aviators for combat helicopter training (initial qualification course) based upon the assignment needs of the Army? *Response: Yes.*

(2) How much consideration (or weight) is given to the Officer Preference Statement and/or DA Form 4187 (Personnel Action) of an aviator desiring to fly a combat helicopter? *Response: Whenever possible the desires of the officer are considered, but except for exceptional situations, the needs of the Army will overrule the desires of the officer during periods of skill shortages or overages.*

(3) Based upon the changes to AR 600-13 reference female assignment policies, have you ever considered assigning a female as a combat helicopter MTP? Why? *Response: Not provided.*

are there any other prerequisites you consider prior to assigning an aviator to a combat helicopter assignment? *Response: There are no other prerequisites, however General Officers can influence the advanced aircraft selection decision cycle.*

D. Combat Helicopter Manprint (Anthropometric Restrictions)

The United States Army Research Institute (ARI) tracks anthropometric restrictions for the IERW Tracks only. Of the four helicopter tracks, two influence this paper, the AH-1 and OH-58 tracks. There is only one anthropometric restriction for each of these airframes. The OH-58 is limited to a maximum sitting height of 95cm. Since the OH-58D uses the same basic cockpit stationing of seat and flight controls, this restriction can be applied to all models of the OH-58 airframe. The AH-1 has a minimum crotch height of 76cm. There are no known anthropometric restrictions tracked by ARI for the AH-64 and RAH-64.[44]

E. Standards of Medical Fitness

Standards of medical fitness for aviators are stated in AR 40-501. Assuming good health, all aviators, whether military or civilian, are restricted to the maximum

allowable body weight and size that doesn't exceed seat, restraint system, or aircraft gross weight design limits. Individual body composition must not prevent normal functions required for safe and effective aircraft flight, to include interference with aircraft instruments and controls. Minimum body size, weight, and physical strength will be that which allows safe and effective flight in Army aircraft to include proper function of ejection seats and other safety equipment.[45]

U.S. Army Pilots must meet height requirements as well as the linear anthropometric criteria (sitting height, total arm reach or span, and crotch height) established by the United States Army Aviation Medical Center (USAAMC).[46] These criteria are:

Sitting Height	$\leq$ 102cm (40.1574 inches)
Span	$\geq$ 164cm (64.5668 inches)
Crotch Height	$\geq$ 75cm (29.5275 inches)

Body weight and composition restrictions don't deviate from the Army standards as published in AR 600-9. Weight is determined with the individual standing on a scale platform in shorts with the reading taken to the nearest 0.1 kilogram. Since all candidates meet these requirements by virtue of their commission, further consideration of weight requirements for selection of females for combat helicopter

training will only be considered in this paper only if body weight affects safety considerations.

F. Anthropometric Statistics

Anthropometry addresses body size accommodation in the cockpit. Body size accommodation is size,not sex, oriented for not all women are small. Individuals of large size as well as small size have difficulty in fitting in the various Army helicopter cockpits.

Individuals of large size usually have problems with leg and overhead clearance in Army helicopters. While individuals of small size usually have difficultly with over-the-nose vision, arm reach to flight controls, and leg reach to pedal controls. Each of the Army's helicopter cockpit's vary by type aircraft, thus a small body size for one helicopter type may not be a problem in another helicopter type.

Anthropometric restrictions are actually cockpit maps that assist in determining what body type fits a particular cockpit due to the differences in helicopter cockpit design. Newer model helicopters are designed to accommodate all Army pilots (male and female) that meet existing linear anthropometric criteria in sitting height, total arm reach, crouch height, and leg length (also referred to in some sources as crotch height).

Candidates for entry into Army aviation programs who are less than 172.7cm (67.9919 inches) in height must have a minimum leg length of 71.9cm (28.30703 inches) and a combined sitting height plus functional reach of 152.9cm (60.19673 inches). For aviators that are less than 167.6cm (65.98412 inches) in height to continue a career in Army aviation helicopters, they must have a minimum leg length of 71.9cm (28.30703 inches) and a combined sitting height plus functional reach of 152.9cm (60.19673 inches).

Army aviation uses the heading dimension to limit aircrews. Height (stature), the vertical distance from the standing surface to the top of the head (scalp) is measured by having the individual stand erect, head in Frankfort plane, heels together, and weight distributed equally on both feet.

Sitting height is determined by having the individual sit erect with the head in the Frankfort plane, upperarms hanging relaxed, forearms and hands extended forward horizontally. Using an anthropometer, the anthropometer arm is positioned to firmly touch the scalp, measuring the vertical distance from the sitting surface to the top of the head.

By having an individual stand erect, heels approximately 10cm apart, with weight evenly distributed between the feet, leg length measurements are taken. The anthropometer arm makes light contact with the individual's crotch and then is rested against the right leg. The

individual brings heels together to maintain the contact of the anthropometer in the crotch. The vertical distance from the standing surface to that level is then recorded.

Measurements of an individual's functional reach require the subject to stand erect in a corner looking straight ahead, both shoulders against the back wall, right arm horizontal and held against a scale mounted on the side wall. The tip of the index finger touches the pad of the extended thumb. With a block touching the tip of the thumb, measurements of the horizontal distance from the back wall to the tip of the thumb are made from the wall scale.

The 1988 Anthropometric Survey of U.S. Army Personnel included special information on Army pilots. Until the 1988 survey, the most recent anthropometric data on Army pilots was collected in 1970. Changes in the pilot population from 1970 to 1988 include an increase in the average pilot's age and women. The increased number of female aviators has increased the number of personnel with smaller body size. Consequently, clothing, protective equipment, and workspaces such as the cockpit, originally designed to accommodate males only, must be modified/redesigned to accommodate the larger variation represented by an integrated male/female population.

The pilot sample used to record data for the 1988 survey included 821 subjects, 334 females and 487 males. All subjects were measured for 132 anthropometric

dimensions, although this paper will highlight those dimensions which are related to aircraft anthropometric restrictions. Due to the small number of female Army pilots available for the survey, a female pilot working data base population demographically matched to the female Army pilot population was created. All subjects met the 1988 anthropometric criteria for entrance into flight school.[47] A comparison of selected anthropometric dimensions between 1988 male and female pilots is at Appendix E. Integrated pilot average dimensions are summarized as follows:

DIMENSION	**AVERAGE**
Height	172.56cm (67.94 inches)
Weight	72.74kg (160.36 pounds)
Crotch Height	81.675cm (32.16 inches)
Sitting Height	90.615cm (35.68 inches)
Span	176.775cm (69.60 inches)

G. Evaluation Report of Female Performance in ARMY IERW Training

From July 1974 to July 1979, ARI studied the performance of women and minorities in IERW. Comparisions of each minority group was made against a matched control group. Criteria for selection of a matched control group were Flight Aptitude Selection Test (FAST) scores, General

Technical (GT) scores, civilian education level, age, rank, and source of entry into the Army Aviation service. Students in IERW may enter flight training from one of the sources listed below:

(1) Warrant Officer Candidate (WOC) Civilian Entry. This source is used to assess students with less than six months of military service.

(2) WOC, previous enlisted. If a flight student candidate has more than six months of military service, she/he enters flight school through this source.

(3) Reserve Officers Training Corps (ROTC). This source assesses students as they graduate from civilian colleges/universities.

(4) Officer Candidate School. Students assessed into flight school under OCS are either recent OCS graduates, or direct commissioned individuals, or individuals with a direct appointment as an officer into military service.

(5) United States Military Academy (USMA). Assessed students who have recently obtained their military commission from the military academy as opposed to ROTC or OCS.

Comparisions of the performance of each group (females and their matched control group were made on the following criteria:

(1) Warrant Officer Candidate Military Development Course (WOCD) grades;

(2) Academic grades by phase of training;

(3) Flight performance grades by phase of training;

(4) Overall grade;

(5) Attrition/elimination during WOCD;

(6) Attrition/elimination and recycles during IERW.

Attrition/elimination criteria from flight school:[48]

(1)	Academic	- failure of written exam
		- lack of motivation
		- lack of adaptability
(2)	Flight	- low proficiency
		- slow progress
		- dangerous tendencies
		- fear of flying
(3)	Medical	- as annotated in AR 40-501

(4) Miscellaneous - lack of prerequisites
- misconduct
- death
- compassionate discharge
- insufficient service
- recall by organization
- erroneous enrollment
- withdrawal in good standing
- honor code violation
- character deficiency
- absent without leave
- resignation
- other (military development deficiency)

Appendix F presents a summary of this study's research efforts in support of this thesis. It is important to note that the IERW course program of instruction (POI) used during the time period (1974-79) of the ARI study differs predominately from the current IERW POI in airframe changes for primary and transition training, and the multi-track concept. Under multi-track, all helicopter pilots receive the same core training until reaching the tactics phase. During this phase students are selected for either the AH-1, OH-58A/C, UH-60, or UH-1H track for tactical training.

Track selection is mutually dependent upon the aviator's first utilization tour requirements.

The IERW study asked the following questions of female aviator performance:

(1) Do female students have academic and/or flight grades equivalent to their male counterparts in either WOCD and/or IERW?

(2) Do attrition/elimination/recycle rates differ for females?

Academic gades for IERW and WOCD military grades are determined by a student's performance on written evaluations. These evaluations require either short answer, multiple choice, or true/false responses to test questions.

Flight evaluation grades for IERW are computed as an average of the IP putup grade and the checkride evaluation grade. Flight performance grades reflect only the student's flight performance in each of the following phases of training: Primary, Transition, Instruments, Night, and Tactics.

Overall composite grades for IERW are computed for the students by combining the academic and flight performance phase grades. The phase grades are weighted based upon the number of hours of instruction.

Analysis of the data in Appendix F supports the following statements:

(1) There are no significant differences between the performance of females or their male matched population control group in performance grades (academic or military development) during WOCD.

(2) Females exhibited no significant performance differences in flight training when compared to their matched male control groups at either the individual training phase grades or overall IERW grade.

(3) Attrition/elimination and recycle rates indicated no significant differences between females and their matched male control group.

Based upon the absence in the ARI study of any significant performance differences between males and females while undergoing flight training, it is probable that similiar results will be noted when gender restrictions are lifted from the attack helicopter POIs.

CHAPTER 5

CONCLUSION

In support of Army Aviation's continuing effort to improve the efficiency of the selection and training of combat helicopter pilots, I considered three pilot selection options. Each of the three options focused on how to best select female pilots for combat helicopter training. These options are:

a. Design a combat helicopter selection program specifically for female aviators.

b. Integrate female aviators into the current combat helicopter training selection program used for male aviators.

c. Redesign the current combat helicopter training selection program to change some of the selection criteria to increase the number of eligible female aviators.

By applying the criteria of feasibility, acceptability, and suitability to the three options, the best option for selecting female pilots for combat helicopter training is option B. Justification supporting the selection of option B considered the following rationale.

The combat helicopter transition selection criteria is much more complex for IERW students than for IERW graduates. As an IERW student, selection criteria center on the student's ranking and aircraft compatibility recommendation as a result of the Algorithm Test. This test considers a student's personality, mechanical reasoning, visual spatial ability, quantitative ability, IERW core curriculum performance (academic and flight), anthropometry, instructor pilot recommendations, student aircraft preferences, previous flight experience, and the needs of the Army. The Algorithm Test has no gender bias, as females recommended by the test for combat aircraft IERW tracks are disregarded.

IERW graduates are selected for combat helicopter transitions based predominately on the needs of the Army along with officer preference requirements whenever possible. General Officers can at times influence the selection decision-making cycle when appropriate in support of mission considerations. Female aviators are simply not considered for combat aircraft because of current assignment limitations in support of Army policy (AR 600-13).

Combat helicopter anthropometric restrictions are the minimum crotch height for the AH-1 helicopter (76cm) and the maximum sitting height for the OH-58 (95cm). The average female pilot crotch height of 79.17cm and the average sitting height of 88.28cm indicate that anthropometry would

not be a significant factor for female rejection from combat helicopter transition selection.

No significant standards of medical fitness applicable to just the operation of combat helicopters has been determined. Current anthropometric restrictions are present in the selection of pilots for the older combat aircraft airframes, the OH-58 and AH-1. But the pilot selection restrictions for selection into these aircraft affects short/tall males as well as short/tall females. Due to the relatively small number of female pilots among the total Army pilot population (4 percent or 256 female Army pilots were counted in 1992 by PERSCOM for data presented to the Presidential Commission studying the Utilization of Women in the Military hearings in San Francisco, CA, September 1992), there are many more small male pilots than small female pilots. Thus the more modern combat aircraft cockpits have been designed to accommodate more of the male pilot population anthropometrically and in doing so these cockpits will accommodate more female pilots anthropometrically as well.

The current Army combat aircraft inventory doesn't require any special aircraft modifications to accommodate female pilot body size because all Army pilots must meet the same entrance requirements. The pilot program entry anthropometric requirements are non-gender specific. Any Army aviator candidate less than 172.7cm in height must have

a minimum leg length of 71.9cm and a combined sitting height plus functional reach of 152.9cm in order to qualify for a minimum height waiver.

Females have demonstrated consistent performance in IERW with no major differences in academic or flight performance that can be attributed to gender. The current Algorithm Test used by USAAVNC is an excellent method to evaluate student potential for advanced aircraft transitions. Without regard for sex or race, this test evaluates a students mental and physical attributes, attitude, and aptitude for the mission roles of the Army's various advanced aircraft which includes the combat aircraft --the OH-58DI, AH-1, AH-64, and RAH-66 (when fielded).

The process to select already qualified aviators for combat helicopter training is primarily based upon the needs of the Army with consideration for an officer's stated preference on the Officer Preference Statement, and any situation operational requirements of special interest to General Officers.

Thus option B is the best method for selecting female aviators for combat helicopter training.

Feasibility

Option B can be implemented at almost no cost to Army aviation since it is just a matter of dropping gender

restrictions from the available aviator population. Modifications to AR 600-13 (Army Policy for the Assignment of Female Soldiers) and DA Pam 351-4 (United States Army Formal Schools Catalog) for supporting assignment policy procedures and deletion of gender restrictions respectively.

The Algorithm Test gender bias is subjectively applied to advanced aircraft tracks to eliminate recommended female aviators for combat training. Integration of female aviators into combat helicopter tracks as a part of IERW can be accomplished by dropping the requirement for subjective gender bias and by educating IPs that they can recommend female aviators as well as male aviators for the combat helicopter tracks.

Personnel managers at PERSCOM can simply expand their available pilot population to consider either gender of aviator as part of the assignment process to meet the Army's aviator needs for various aircraft systems.

Acceptability

Since there are no gender specific mental or physical restrictions for consideration in training females to fly combat helicopters, option B can effectively select female aviators along with male aviators for combat helicopter training.

Suitability

Implementation of option B is not resource intensive. No additional manpower, facilities, or equipment are necessary to select female aviators for combat aircraft training. All aviators must meet the same flight training entry requirements. The anthropometric restrictions for the OH-58 (sitting height) and AH-1 (crotch height) may exclude some otherwise eligible females. However, the percentage of females excluded shouldn't vary significantly from the percentage of tall/short male pilots excluded from these aircraft as well because of anthropometry since there are many more male aviators than female aviators.

CHAPTER 6

RECOMMENDATION

No changes in the selection criteria in the Army's current combat helicopter pilot selection programs will be needed to expand the eligible pilot population to include both male and female aviators. Both the Algorithm Test for selecting IERW students for combat helicopter transitions, and PERSCOM's procedure for selecting and assigning aviators to combat helicopter units which require a combat helicopter transition should be expanded to include females by just eliminating the current female gender exclusion policy.

RECOMMENDATIONS FOR FURTHER STUDY:

1. Aircraft accommodation. The following anthropometric measurements, while not currently tracked among Army aviators, may indicate an anthropometric incompatibility in the man-machine interface. This incompatibility should be studied to determine if aircraft handling safety is impaired, and if current aircraft manprint design criteria can accommodate the complete range of body sizes found among aircrew personnel.

Anthropometric dimensions that impact aircraft accommodation are:

Bideltoid Breadth

Buttock-Knee Length

Dactylion Reach From Wall

Forearm-Forearm Breadth

Functional Leg Reach

Hand Length

Sitting Height*

Span*

Thumbtip Reach

Vertical Grip Reach Down

Weight

Wrist-Center of Grip Length

Wrist-Thumbtip Length

Wrist-Wall Length

* Dimensions already tracked by USAAVNC.

2. Social-psychological impact. The initial adaptation of female combat helicopter pilots into traditionally all male units will probably strain the operational work environment until the curiosity of female combat helicopter pilots wears off. Integration would most likely go more smoothly if females flying combat helicopters are not treated as a curiosity. Keep press coverage and special attention to a

minimum, none is best, and just let the female combat pilots do their job. If they can be kept from becoming the center of attention, the integration transition time would most likely be shortened.

3. Physical body strength. As mentioned in chapter two for this paper, the Army Aeromedical Research Laboratory has studied the capability of pilots to manipulate simultaneously more than one flight control in an emergency situation with reduced-to-no mechanical assistance for flight control manipulation. In their study, 50% of the men and 90% of the women failed to meet strength requirements. Further study should be continued to determine if any of the Army's inventory of helicopters, especially the older models, require a minimum strength capability of the pilot. Such a standard should be tempered by the fact that reports of pilots have difficulty manipulating the controls because of strength deficiencies are extremely rare.

The recent decision by the Secretary of defense to open combat aviation to female pilots, enhances aviation readiness. My study demonstrates there are no significant mental, emotional, or physiologically unique characteristics of the female pilot that affects the type of aircraft she flies or the mission she can perform. Technology has made men and women equals in the cockpit. Thus, by having more

pilots to chose from, the chances of selecting those pilots with the best aptitude, attitude, and technical capabilities for the cockpits of combat helicopters are significantly increased.

Due to the limited number of field grade female pilots with scout helicopter experience (OH-58A/C), I anticipate the majority of the initial female combat pilots to be selected from the company grade and warrant officer ranks. This will provide the necessary career progression sequence to grow tactically and technically competent female attack pilots for today, and the combat aviation leaders of tommorrow.

Finally, the decision to place women in combat helicopters will have two secondary impacts on the force. First, an additional estimated 6000 duty positions will be opened to women in aviation career tracks across the entire rank spectrum. This increase in job opportunities should enhance recruitment of talented women into aviation. Second, the inclusion of women in combat helicopters will increase the demand on the logistical system for individual equipment at the smaller size end of the spectrum. By increasing the stockage/availability of smaller sized items, smaller male pilots will enjoy easier access to better fitting individual equipment (i.e., supply and demand).

Army Aviation has always prided itself in operations "Above the Best!" By dropping the gender discriminator for

the combat helicopter pilot selection processes, the Army continues to make the most of its available personnel resources. During this period of building the Army down, making the most of available resources is a vital link to sustaining the United States Armed Forces as the best in the world.

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APPENDIX A

GLOSSARY

Acceptability. Adequate and/or satisfactory. Will be accepted as true, proper, normal, or inevitable.

Anthropometry. Study of comparative measurements of the human body.

Battalion size unit (combat). A military organization composed of approximately 450-500 soldiers.

Checkride. Flight evaluation.

Direct Combat. Engaging an enemy with individual or crew served weapons while being exposed to direct enemy fire, a high probability of direct physical contact with the enemy's personnel and a substantial risk of capture. Direct combat takes place while closing with the enemy by fire, maneuver, and shock effect in order to destroy or capture the enemy or while repelling the enemy's assault by fire, close combat, or counterattack. (AR 600-13, p. 8.)

Drop Zone. Airborne Landing Area

Flight Aptitude Selection Test (FAST). Test designed to measure aptitudes and personality/background characteristics that are predictive of success in Army flight training. The FAST test used for the subjects in this study had two batteries, one for officers and one for warrant officer candidates. A minimum score of 155 and 300 are required for entry into the flight program for officers and warrant officer candidates respectively. This FAST is superseded by a revised version implemented in February 1980.

Feasibility. Capable of being done or carried out. Monetarily affordable.

Female officers/aviators. Includes both female commissioned and warrant officers.

Field Awarded Skill. Specialty skill designation awarded by local PSC based upon local confirmation that the criteria stated in DA PAM 600-3, "Commissioned Officer Professional Development and Utilization", have been met.

Frankfort Plane. The standard horizontal plane or orientation of the head. The plane is established by a line passing through the right tragion (approximate earhole) and the lowest point of the right orbit (eye socket).

General Technical (GT). General technical component of the Armed Forces Vocational Aptitude Battery (ASVAB). The GT represents a composite of the arithmetic reasoning and word knowledge subtests.

Hypoxia. A deficiency of oxygen reaching the tissues of the body.

Initial Entry Rotary Wing (IERW). The primary helicopter qualification course for the Army. Commonly referred to as flight school.

Instrument Stage. Stage of training were students learn instrument flight procedures.

Manprint. Human factors engineering and systems analysis to help soldier-machine systems reach maximum performance within specified constraints.

Occupational Training. Training in courses which lead to qualification or increased proficiency in a current authorized warrant officer MOS.

Overall Grade. Composite grade for students completing flight training. Composed of academic and flight grades weighted by factors such as number of hours of instruction.

PERSCOM Controlled Skill. Specialty skill designation controlled and awarded by Commander, PERSCOM, ATTN: (Appropriate Assignment Officer), 200 Stovall Street, Alexandria, VA, 22332-0412.

Primary Stage. Stage of training were flight dynamics and theory plus TH-55 (for this study's subjects) helicopter flight skills are taught.

Put-up. Anticipated flight evaluation score a student will get on a checkride. Put-up gradeslips are completed by the student's training Instructor Pilot (IP) prior to a flight evaluation.

Qualified for Aviation Duty. Personnel who have completed IERW (flight school) as well as those personnel who have qualified for flight school and are either enrolled in flight school or are awaiting their class start date.

Recycle. Student set back to a subsequent class in IERW for retraining.

Rotary Wing Attack/Scout Pilot. Pilots and commands attack and scout helicopters under tactical and nontactical conditions. Operates aircraft during all types of meteorological conditions during day, night, and under night vision devices. responsible for coordinating, conducting, and directing combat attack/scout operations, Joint Air Attack Team operations, and indirect fire missions. Participates in anti-armor operations, reconnaissance missions, security missions, and combat maneuver operations. Functions as a direct participant of battle with organic armament systems. (AR 611-112, p. 32.)

Skill Identifier (SI). Two characters (one numeric and one alpha) used to identify the additional skill requirements of a position as well as the additional skills in which officers are classified. (AR 611-101, p. 3.)

Suitability. Qualified, fit, adaptable to a use or purpose.

Tactics Stage. Stage of flight training were students learn basic combat skills.

Transition Stage. Stage of flight training were the student learns to fly the UH-1H helicopter.

TOW. Tube launched, optically tracked, wire-guided missile.

Warrant Officer Candidate Development Course (WOCD). A six-week course for warrant officer candidates that precedes flight school. This course focuses on the military development of potential warrant officers. Course was replaced by the Warrant Officer Entry Course (WOEC) in the late 1980s.

APPENDIX B

UNITED STATES CODE TITLE 10, SECTION 8549

Assignment of Women in the United States Air Force

§ 8549. Duties: female members; limitations

Female members of the Air Force, except those designated under section 8067 of this title, or appointed with a view to designation under that section, may not be assigned to duty in aircraft engaged in combat missions. Aug. 10, 1956, c. 1041, 70A Stat. 528.

Historical and Revision Notes

Revised Section	Source (U. S. Code)
8549	5:627f(a) (proviso)

Source (Statutes at Large)

June 12, 1948, ch. 449, § 307(a) (proviso), 62 Stat. 373.

Explanatory Notes

The words "other than those designated under section 8067 of this title or appointed with a view to designation under that section" are inserted, since 5:627f(a), as enacted, was applicable only to women appointed under Title III of the Women's Armed Services Integration Act of 1948, of which it was a part, and not to those appointed under other provisions of law.

Source: USC-Annotated, 1980

[§ 8549. Repealed. Pub.L. 102-190, Div. A, Title V, § 531(a)(1), Dec. 5, 1991, 105 Stat. 1365]

Section, Aug. 10, 1956, c. 1041, 70A Stat. 528, prohibited assignment of female members to duty in aircraft engaged in combat.

Source: USC-Annotated, 1992 Update

UNITED STATES CODE TITLE 10, SECTION 6015

Assignment of Women in the United States Navy

(Code Revision)

§ 6015. Women members: duty; qualifications; restrictions

The Secretary of the Navy may prescribe the manner in which women officers appointed under section 5590 of this title, women warrant officers, and enlisted women members of the Regular Navy and the Regular Marine Corps shall be trained and qualified for military duty. The Secretary may prescribe the kind of military duty to which such women members may be assigned and the military authority which they may exercise. However, women may not be assigned to duty in aircraft that are engaged in combat missions nor may they be assigned to duty on vessels of the Navy other than hospital ships and transports. Aug. 10, 1956, c. 1041, 70A Stat. 375.

Historical and Revision Notes

Source (U. S. Code)

34 U.S.C. 105g
34 U.S.C. 625h(a)

Source (Statutes at Large)

June 12, 1948, ch. 449, § 210, 62 Stat. 368.
June 12, 1948, ch. 449, § 213(a), 62 Stat. 369.

Explanatory Notes

The limitation to "women officers appointed under section 5590" is inserted to avoid application of the section to officers in the Nurse Corps, as required by 34 U.S.C. 105k, and to avoid application to women appointed in the Medical Corps, Dental Corps, and Medical Service Corps under 34 U.S.C. 21e, as required by that section.

Source: USC-Annotated, 1980

UNITED STATES CODE TITLE 10, SECTION 6015

Assignment of Women in the United States Navy

(Code Revision-Continued)

§ 6015. Women members; duty; qualifications; restrictions

The Secretary of the Navy may prescribe the manner in which women officers, women warrant officers, and enlisted women members of the Regular Navy and the Regular Marine Corps shall be trained and qualified for military duty. The Secretary may prescribe the kind of military duty to which such women members may be assigned and the military authority which they may exercise. However, women may not be assigned to duty on vessels that are engaged in combat missions (other than as aviation officers as part of an air wing or other air element assigned to such a vessel) nor may they be assigned to other than temporary duty on other vessels of the Navy except hospital ships, transports, and vessels of a similar classification not expected to be assigned combat missions.

(As amended Oct. 20, 1978, Pub.L. 95-485, Title VIII, § 806, 92 Stat. 1623; Dec. 12, 1980, Pub.L. 96-513, Title V, § 503(44), 94 Stat. 2914; Dec. 5, 1991, Pub.L. 102-190, Div. A, Title V, § 531(b), 105 Stat. 1365.)

HISTORICAL AND STATUTORY NOTES

1991 Amendment

Pub.L. 102-190 inserted "(other than as aviation officers as part of an air wing or other air element assigned to such a vessel)" following "combat missions" and "other" following "temporary duty on", and struck out "or in aircraft" preceding "that are engaged".

1980 Amendment

Pub.L. 96-513 struck out "appointed under section 5590 of this title" following "The Secretary of the Navy may prescribe the manner in which women officers".

1978 Amendment

Pub.L. 95-485 substituted provision prohibiting assignment of women to duty on vessels or in aircraft engaged in combat missions or assignment, other than to temporary duty, on naval vessels except hospital ships, transports, and vessels of similar classification not expected to be assigned combat missions for provision prohibiting assignment of women to duty in aircraft engaged in combat missions or duty on naval vessels other than hospital ships or transports.

Effective Date of 1980 Amendment

Amendment by Pub.L. 96-513 effective Sept. 15, 1981, see section 701 of Pub.L. 96-513, set out as a note under section 101 of this title.

Legislative History

For legislative history and purpose of Pub.L. 96-513, see 1980 U.S. Code Cong. and Adm. News, p. 6333. See, also, Pub.L. 102-190, 1991 U.S. Code Cong. and Adm. News, p. 918.

WEST'S FEDERAL PRACTICE MANUAL

Legal authority as defense, see § 16341.
Sex discrimination in military service, see § 15537.

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Source: USC-Annotated, 1992 Update

UNITED STATES CODE TITLE 10, SECTION 6015

Assignment of Women in the United States Navy

(Code Revision-Continued)

NOTES OF DECISIONS

½. Constitutionality

Women, who were excluded from combat service by statute or military policy, and men were not similarly situated for purposes of a draft or registration for a draft; thus, Congress' decision to authorize registration of only men did not violate due process clause of U.S.C.A. Const. Amend. 5. Roster v. Goldberg, Pa.1981, 101 S.Ct. 2646, 453 U.S. 57, 69 L.Ed.2d 478.

Provision in this section barring assignment of female personnel to duty on navy vessels other than hospital ships and transports violates equality principle embodied in U.S.C.A. Const. Amend. 5. Owens v. Brown, D.C.D.C.1978, 455 F.Supp. 291.

1. Judicial review

Constitutional validity of Marine Corps regulation which mandated the discharge of women marines for pregnancy was subject to judicial review. Crawford v. Cushman, C.A.Vt.1976, 531 F.2d 1114.

Under either traditional or strict scrutiny standard, congressional classification of men and women into two categories for service upon combat vessels mandated by statute which provides that women may not be assigned to duty on Navy vessels other than hospital ships and transports violated no equal protection rights of plaintiff, an unsuccessful applicant for Naval Reserve Officers Training Corps four-year scholarship, and thus difference between number of scholarships awarded and standards of eligibility for men and women were rationally related to provision, maintenance, government and regulation of the Navy. Kovach v. Middendorf, D.C.Del.1976, 424 F.Supp. 72.

2. Waiver

Without independent legal advice, female marine's failure to object to her discharge, under Marine Corps regulation which mandated the discharge of women marines for pregnancy, could not be treated as a "knowing" waiver of objection. Crawford v. Cushman, C.A.Vt.1976, 531 F.2d 1114.

3. Regulations

While the Marine Corps may as a matter of substantive policy constitutionally be given ample latitude to discharge an employee for pregnancy, as for any other disability where mobility and readiness or ability to perform work is likely to be impaired for any substantial period of time, the area appears to be one where the military police formulation and application is constitutionally required to take the form of individual decision making since the ability of the individual employee to cope with the needs of the job is dependent upon her individual abilities. Crawford v. Cushman, C.A.Vt.1976, 531 F.2d 1114.

Marine Corps regulation which mandated the discharge of women marines for pregnancy could not rationally be justified on the basis of the administrative convenience of "knowing where your people are and their capacity to respond." Id.

4. *Assignment of female personnel*

Alleged morale and discipline problems caused by integration of men and women aboard navy ships furnished no basis for upholding ban on assignment of female personnel to duty on navy vessels other than hospital ships and transports since whatever problems might arise from integrating ships and crews were matters that could be dealt with through appropriate training and planning. Owens v. Brown, D.C.D.C.1978, 455 F.Supp. 291.

Fact that military affairs were implicated did not mean that challenge to ban on assignment of female personnel to duty on navy vessels other than hospital ships and transports raised a nonjusticiable political question. Id.

Likelihood of influencing legislative efforts to revise ban on assignment of female personnel to duty on navy vessels other than hospital ships and transports did not afford a principled basis for avoiding a determination of whether ban violated U.S.C.A. Const. Amend. 5. Id.

5. *Class action*

Action challenging bar on assignment of female personnel to duty on navy vessels other than hospital ships and transports was certified as class action, notwithstanding concern that some female personnel might not share representative plaintiff's desire to remove such bar, since issue was not whether Navy must assign female personnel to ship duty against their wishes but whether navy authorities must exclude women from ship assignments whether or not they wish to go to sea. Owens v. Brown, D.C.D.C.1978, 455 F.Supp. 291.

Source: USC-Annotated, 1992 Update

APPENDIX C

TABLE 1

PROJECTED PROPORTION OF FEMALES EXCLUDED
BY RAF AIRCREW MINIMUM ENTRY LIMITS

Dimension	RAF Limit (cm)	Proportion of Females Excluded
Sitting Height	86.5	60%
Thigh Length	56.0	30%
Leg Length	100.0	not available
Functional Reach	74.0	50%

Source: Turner, AGARD

APPENDIX D

TABLE 2

THE ROYAL NETHERLANDS AIR FORCE SELECTION PROCEDURES FOR PILOTS

First Day:

- Personality Tests
- Spatial Insight Tests
- Apparatus Tests (Pilot Motorics)
- Reaction Speed Test

Second Day:

- Interview with Selection-Psychologist
- Function Information

Third Day:

- Medical Examination

[All of the above takes place at Air Force Base Gilze-Rijen]

Fourth Day:

- Extensive X-Ray Photographs of back and neck vertebrae at Matthijsen Military Hospital in Utrecht

Fifth Day:

- Flight medical Examination at National Air and Space Medicine Center in Soesterberg

Fours Days:

- Automated Pilot Selection: Six "Flights" on a Flight Simulator at Air Force Base Gilze-Rijen

Four or Five Days:

- Practical Pilot Selection: Several Flights with the Slingsby Aircraft at Airfield Seppe.

Presented by 1st Lieutenant Marielle Winnubst, Royal Netherlands Air Force, "The Selection, Training and Operational Work of Female Helicopter Pilots in the Royal Netherlands Air Force", Aerospace Medical Panel Symposium, Tours, France, 4-5 April 1990.

TABLE 3

THE TRAINING OF DUTCH HELICOPTER PILOTS

Phase of the Training	Duration	Flightime/Type
Elementary Military Flight Training	40 Weeks	43 Hours in Pilatus/PC-7
Advanced Flight Training	40 Weeks	90 Hours in Pilatus/PC-7
Helicopter Flight Training	15 Weeks	100 Hours in Alouette III
Air Navigator Training	7 Weeks	None as Pilot
Elementary Tactical Helicopter Training	10 Weeks	75 Hours in Alouette III

Status upon completion: Limited Combat Ready Pilot

After flying at the Squadron for 18 months on either the Alouette II Helicopter or the Bolkow 105 Helicopter, the Pilot enters:

Phase of the Training	Duration	Flightime/Type
Advanced Tactical Helicopter Training	12 or 16 Weeks	70 Hours on current helicopter type

Status Upon Completion: Fully Combat Ready

Source: Winnubst, AGARD

APPENDIX E

TABLE 4

CANADIAN FORCES PILOT ANTHROPOMETRIC SELECTION STANDARDS

Dimension	Minimum (cm)	Maximum (cm)
Height	157.7	193.1
Sitting Height	86.4	100.3
Leg Length	99.6	123.2
Thigh Length	54.6	67.3

Note: 94 percent of USAF males and 36 percent of USAF females can meet these criteria.

Source: Pigeau, AGARD

APPENDIX F

TABLE 5

IERW DEMOGRAPHIC
July 1974-79

Rank	Raw Population Male	Raw Population Female	Matched Population Male	Matched Population Female
Commissioned Officer	1609	27	15	15
Warrant Officer	2609	50	27	27
TOTAL	4218	77	42	42

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

TABLE 6

COMPARISON OF FEMALES AND MATCHED CONTROL GROUPS

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

I. FAST/GT/ED LEVEL/AGE*

GROUP	FAST	GT	ED LEVEL	AGE
FEMALE	321.4	134.7	13.1	22.8
MATCHED CONTROL GROUP	321.8	135.7	13.52	23.5

* NO SIGNIFICANT DIFFERENCES BETWEEN THE TWO GROUPS.

II. AVERAGE ACADEMIC GRADES*

GROUP	AVERAGE ACADEMIC GRADE
FEMALE	86.11$\pm$6.37 percent
MATCHED CONTROL GROUP	84.55$\pm$5.61 percent

* Females demonstrated slightly higher academic grades than their matched control group. Difference is not great enough to be significant for this thesis.

COMPARISON OF FEMALES AND MATCHED CONTROL GROUPS (Continued)

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

III. IERW ACADEMIC GRADES (BY STAGE)

AVERAGE ACADEMIC GRADE (by Stage)	FEMALE	MATCHED CONTROL GRP
PRIMARY	86.90±5.23	88.03±4.96
TRANSITION	91.21±7.23	92.78±5.91
INSTRUMENT	90.36±5.97	90.14±6.37
NIGHT	95.27±4.52	91.64±5.66
TACTICS	84.50±6.04	87.00±7.51

Both groups exceed minimum passing score (70.00). Both groups demonstrate consistent performance until the tactics phase when female performance in the classroom slipped. Reasons for this are not available.

IV. IERW FLIGHT GRADES (BY STAGE)

Each grade has three parts to it. The first part is the IP 'put-up' grade. Prior to the checkgrade or phase flight evaluation, each IP prepares an evaluation slip predicting student performance based upon performance demonstrated in training. This gradeslip is kept confidential until the flight evaluation is completed. The second grade is the checkride IP grade. An evaluation IP tests the student and

COMPARISON OF FEMALES AND MATCHED CONTROL GROUPS (Continued)

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

prepares a gradeslip based upon demonstrated performance during the checkride (flight evaluation). The third grade is the total grade awarded to the student for that phase of training. This grade is the average of the put-up grade and the checkride grade.

AVERAGE FLIGHT GRADE (by Stage)	FEMALE	MATCHED CONTROL GRP
PRIMARY		
Put-up	85.33±2.09	84.44±2.14
Ch'kride	83.11±3.35	82.22±5.17
Total	84.67±2.20	83.27±3.56
TRANSITION		
Put-up	84.33±5.28	86.26±2.98
Ch'kride	83.37±5.91	83.71±6.10
Total	84.23±4.72	85.00±3.72
INSTRUMENTS		
Put-up	84.35±4.85	84.13±3.73
Ch'kride	83.61±6.53	81.74±5.96
Total	84.72±4.77	82.62±4.35
NIGHT		
Put-up	86.33±2.83	87.55±1.51
Ch'kride	86.11±2.80	88.33±1.80
Total	86.15±3.21	86.92±2.50
TACTICS		
Put-up	88.71±3.04	89.14±3.80
Ch'kride	87.28±3.86	84.28±4.99
Total	86.00±5.86	86.91±3.96

COMPARISON OF FEMALES AND MATCHED CONTROL GROUPS (Continued)

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

V. IERW OVERALL GRADE

Overall grade reflects the total military, academic, and flight performance of each student throughout the entire IERW course. The grades for each phase are weighted by the number of hours of instruction in each phase. Acceptable scores for successful completion of IERW are within the score range of 70 to 100 percent.

GROUP	OVERALL GRADE
FEMALE	85.68±2.95 percent
MATCHED CONTROL GROUP	86.23±3.12 percent

VI. WOCD ATTRITION

GROUP	ATTRITION/ELIMINATION RATES
FEMALE	15 percent (4 Personnel)
MATCHED CONTROL GROUP	11 percent (3 Personnel)

Attrition rates are constant with eliminations historically associated with WOCD.

COMPARISON OF FEMALES AND MATCHED CONTROL GROUPS (Continued)

DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991)

VII. IERW RECYCLE AND ATTRITION

GROUP	ATTRITION /ELIMINATION RATES	RECYCLE RATES
FEMALE	11 percent (4 Personnel)	37 percent (14 Personnel)
MATCHED CONTROL GROUP	8 percent (3 Personnel)	26 percent (10 Personnel)

Reasons for recycles were attributed to individual learning difficulties. No learning difficulties associated with gender indicated.

Attrition rates are constant with eliminations historically associated with IERW.

APPENDIX G

TABLE 7

ANTHROPOMETRIC POPULATION DISTRIBUTIONS
Mean Averages for Male (M), Female (F),
and Total (T) Sample Population

Dimension	M/F/T Average	M/F/T 5th%	M/F/T 95th%
HEIGHT (cm)	M/177.10	M/166.33	M/187.75
	F/168.02	F/161.17	F/175.95
	T/172.56	T/163.75	T/181.85
WEIGHT (kg)	M/79.92	M/65.32	M/97.17
	F/65.51	F/52.64	F/80.73
	T/72.715	T/58.98	T/88.95
CROTCH HEIGHT (cm)	M/84.18	M/77.52	M/91.51
	F/79.17	F/75.54	F/83.91
	T/81.675	T/76.53	T/87.71
SITTING HEIGHT (cm)	M/92.95	M/87.23	M/98.18
	F/88.28	F/83.58	F/92.78
	T/90.615	T/85.405	T/95.48
SPAN (cm)	M/182.79	M/170.21	M/195.61
	F/170.76	F/164.55	F/180.08
	T/176.775	T/167.38	T/187.845

NOTES:
1. DATA Source: 1988 Anthropometric Survey of U.S.Army Personnel: Pilot Summary Statistics (1991).

2. Conversion factors:
cm x .3937 = inches kg x 2.2046 = pounds

ANTHROPOMETRIC POPULATION DISTRIBUTIONS
Mean Averages for Male, Female, and Total Sample Population
(Continued)

3. The 1st and 99th percentiles are excluded from this chart because of current design restrictions. In accordance with these restrictions, the 1st% is excluded because 5% of the white male population is too small to fly Army aircraft. The 99th% is excluded because 5% of the white male population is too tall to fly Army aircraft.

4. The mean age of the male sample population is 32.68 years. The mean age of the female sample population is 29.36 years.

APPENDIX H

INTERVIEW RECORDS

PERSCOM

1. Phonecon with CPT Kurt Fedors, Project Officer, Aviation Plans and Programs Section, OPMD, U.S. Total Army Personnel Command (PERSCOM), 200 Stovall Street, Alexandria, Virginia, 22332-0413, (703)-325-8156/5170, 1 April 1993.

2. Reference: Transition into advanced aircraft (UH-60, CH-47D, AH-64, AH-1, OH-58DI).

3. Summary of interview:

a. PERSCOM considers needs of the Army in making advanced aircraft transition assignments.

b. PERSCOM personnel managers study personnel files to determine transitions into specific aircraft. There study includes consideration of past duty assignment utilization and officer preference as indicated on the officer assignment preference statement.

c. Sometimes General Officers get involved in the advanced aircraft transition decision cycle.

d. PERSCOM longitudinally tracked 100 Lieutenants on their follow-on transitions into advanced aircraft after completion of their first aviation utilization tour. Only

25 will not be offered an advanced aircraft transition because of the needs of the Army for UH-1H and OH-58A/C aviators.

e. Selection procedure is the same for warrant and commissioned officers.

USAAVNC

1. Phonecon with Mr. Robert Haygens, Project Technician, Directorate of Training and Doctrine, U.S. Army Aviation Center, Fort Rucker, Alabama, 36362-5000, (205)-255-2008/2748, 1 April 1993.

2. Reference: Selection for transition into IERW attack aircraft tracks.

3. Summary of interview:

a. Student selections for AH-1 and OH-58 IERW tracks are determined based upon a specially developed Algorithm test, consideration of previous flight experience (if any), and the needs of the Army as determined in coordination with PERSCOM personnel managers.

b. Within the first ten days of IERW, all students take a four-hour computerized battery of tests known as the Algorithm Test. This is part one of two major sets of data inputs to complete the Algorithm Test.

c. The second part of the major data set inputs to complete the Algorithm Test occurs between the 90th and 95th day of IERW common core training. The second data set includes evaluation results of part one data, the Algorithm Test battery, Anthropometric data (sitting height only), class standing, academic grades, flight performance grades, student preference statements, Primary Phase IP

recommendation, and Instrument Phase IP recommendation. (All of this information is computerized). The Algorithm program completes its computations and categorizes students demonstrating the best aptitude for each advanced (attack) aircraft transition. The USAAVNC student training manager reviews the list, weighing the test proposals for those with previous flight experience, as well as disregard any female students that may have been recommended for an attack aircraft transition. The list is then verified with personnel managers to insure the needs of the Army are being met before final transition selections are made and posted for the students.

d. Anthropometric restriction considered is sitting height. Students with a sitting height greater than 95cm are restricted from flying the OH-58.

e. Algorithm Test battery:

(1) Complex Cognitive Abilities Battery:

(a) Towers of Hanoi Test;

(b) Information Purchase Test;

(c) Word Acronyms Test;

(d) MARK Numbers Test;

(e) Numbers and Words Test.

(2) Two tests borrowed from the Air Force's battery of tests for pilot selection:

(a) Word Knowledge Test;

(b) Manikin Test (measures spatial perception).

(3) Dr. Helmerick, University of Texas, Attitude Survey test. This test is a part of the battery of tests used by NASA in pilot selection.

(4) Two tests borrowed from the Navy's battery of tests for pilot selection:

(a) Hand-Eye Coordination Test;

(b) Mental Abilities Test.

(5) Diotic Listening:

(a) Stick and Rudder Trials;

(b) Axis Tracking, both with and without diotics.

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