

CHAPTER 3

ATTITUDES, STEREOTYPES AND PREJUDICES REGARDING WOMEN IN AVIATION

3.1 INTRODUCTION

For decades, female aviators have had to defy social prejudices, despite their having achieved remarkable feats of skill and endurance. 'Men do not believe us capable,' the famed aviatrix Amelia Earhart once remarked to a friend. 'Because we are women, seldom are we trusted to do an efficient job' (Moolman, 1981:7).

When Charles Lindbergh visited the Soviet Union in 1938 with his wife Anne – herself a pilot and a gifted proponent of aviation – he was astonished to find that both men and women flew in the Soviet Air Force. Later, he confided in his diary: 'I don't see how it can work very well. After all, there is a God made difference between men and women that even the Soviet Union can't eradicate' (Moolman, 1981:7).

Like all pilots in the early days of aviation, women risked their lives every time they flew fragile aircraft made of wood, wire and cloth. When male aviators were killed in aviation accidents, society saw it as bad luck. However, when Harriet Quimby was killed in 1912 when she fell out of her plane during an exhibition flight, it was said to prove that women could not fly. According to the New York Sun, 'Harriet Quimby's death showed that women lack strength and the presence of mind and courage to excel as aviators' (Yount, 1995:10).

By the 1930's, people were eager to see or hear about women pilots, partly because these women's successes suggested that flying was safe enough for even 'the weaker sex'. Aircraft companies hired women pilots as demonstrators, hoping that their customers would believe that 'if a woman could fly their plane, anyone could' (Yount, 1995:11). Allowing women to fly planes commercially, however, was an entirely different matter. When aviatrix Ellen Church applied to Boeing in 1930, the company was happy to employ her as the country's first flight attendant, but certainly not as a pilot. Another small airline hired Helen Richey as a pilot in 1934, but the all-male pilots' union forced her to quit within a few months. According to Yount, 'women in aviation have had to face more obvious and

longer lasting discrimination than women in more gender-neutral careers (an example of bias, in a real forum discussion, with regard to all-female aircrews follows in its entirety in Appendix E). To overcome such strenuous opposition, women pilots have had to develop an extraordinary degree of self-confidence and persistence' (Yount, 1995:11).

3.2 ADDRESSING THE MYTHS AS TO WHY WOMEN SHOULD NOT FLY

Women entering any male dominated arena will, more likely than not, experience difficulties. Those who believe that women should not fly either for professional or recreational reasons have cited several arguments. Examples of this includes that females allegedly have less strength than males do, that they are less intelligent, that they have a reduced innate flying ability and that they are an emotional liability, to name just a few.

A more comprehensive discussion of the physiological differences, psychological differences, women's health issues and cultural concerns follows.

3.2.1 Physical considerations

3.2.1.1 Physical strength

One of the most sensitive subjects concerning women aviators (and indeed that of all women in the military) relates to the subject of physical strength and dual standards. According to Baisden, Pokorski and Meyer (1995:22), women only have between 35 per cent and 85 per cent of the strength that males do.

In 1992, the Presidential Commission in the United States conducted a study with the aim of investigating whether women could meet the same physical fitness standards as that expected of men. Its results found that only 3.4 per cent of women achieved a score equal to that of the males' mean score on the United States Army's physical fitness test. The report also added that women suffered twice the number of lower extremity injuries and over four times the number of stress fractures than men did.

The Presidential Commission concluded that, without special training, women naturally only possess 50 to 60 per cent of the upper torso muscular strength and 70 to 75 per cent of the aerobic capacity of men (Barker, 1999).

The lesser physical strength of females remains one of the last obstacles in the issue of combat aviation. When women first started pilot training in the United States Navy, their physical strength training was increased as part of their syllabus. However, this produced only a negative result as it deterred the cadets from their studies and actually produced no real physical strength benefits (Smart, 1998).

Even though it is a scientific fact that women are weaker in terms of physical strength, modern technological improvements in aircraft control systems have eliminated the need for great physical strength in aviators and aviatrices. In 1981 it was determined that the average woman is able to sustain only 55 to 60 pounds (25 to 27 kilograms) of longitudinal stick force on average. However, the use of servo controls, power assisted systems and mechanical boosters were incorporated in order to improve aircraft handling. The control forces needed to fly modern fighter aircraft have been reduced to such low values as three to five pounds per g (1.3 to 2.3 kilograms per g). Colonel Des Barker of the South African Air Force (SAAF) states that the reduced stick force per g of modern aircraft such as the F-18 Hornet is well within the physical strength capabilities of women, even at 9g. Barker further concludes that training and skill is required to pilot a modern fighter aircraft, not excessive strength, and training and skill are not gender specific (Barker, 1999).

3.2.1.2 Anthropometrics

On average, females are smaller physically than males across a broad number of parameters. Aircraft, and especially military aircraft, are designed with a certain range of pilot dimensions and weights and require pilots to fall within these design dimensions. Differences in dimensions between males and females include sitting height, buttock-knee, buttock-heel and functional reach. Women are not only smaller than men but also have different proportions. For example, on average, females have a greater hip breadth by 5 centimetres whilst males are wider across the shoulders by approximately 2.5 centimetres (Smart, 1998:2).

Aircraft cockpit design has focused on accommodating the 5th to 95th percentile male and has caused the rejection of a number of females because of their failure to fall within these parameters.

In 1986, Kenneth W. Kennedy of the Harry G. Armstrong Aerospace Medical Research Laboratory undertook a study in which he sought to derive new cockpit geometries that would allow for the adjustment of a vertical aircraft ejection seat. This would allow a small pilot to be closer to the controls, whilst a bigger pilot would be able to move away from the controls. He further attempted to demonstrate the relative ease with which an engineer can accommodate the 1st to the 99th percentile range of male body sizes (Kennedy, 1986).

Colonel Barker (SAAF) believes that there is no good reason not to change the design range when specifying a new aircraft so long as the new parameters are reasonable (as defined by percentiles and based on anthropometric data). He argues that it is not uncommon for aircraft manufacturers such as the Lockheed Martin Corporation to adjust the size of cockpits to better fit the average anthropometric dimensions of a country's pilots. Pilots from Singapore, for example, are not as tall as pilots from Denmark, yet the F-16 is marketed on a global basis.

Modern military combat aircraft, trainer aircraft and support aircraft are generally designed to accommodate pilots who are between 64 and 77 inches (1.63 metres to 1.96 metres) tall and who have a sitting height of 34 to 40 inches (86 centimetres to 102 centimetres) (Barker, 1999).

Size differences between males and females are not only important in the design of cockpit fit and control, but also have an impact on the issue of safety equipment. This includes helmets, oxygen masks, flying suits, ejection seats and Nuclear, Biological, Chemical (NBC) Defence ensembles (Smart, 1998).

The design criteria of ejection seat and crew-mounted life support equipment allows for approximately 90 per cent of United States males to meet the size requirements, while only 40 per cent of United States females are tall enough to meet the requirements. Females have a smaller cross-sectional area of vertebrae compared with males and therefore female vertebrae are exposed to a greater force per unit area than those of males. Historically, ejection seat sled tests only incorporated the 5th to the 95th percentile of male weights. Ejection seats are designed to operate within a certain mass and centre of gravity range and should the ejection be performed outside of this mass range, the trajectory of the seat may not guarantee safe flight (Barker, 1999). This suggests an increased risk of spinal column injury in females.

In 1998, the U.S. Navy launched a programme for allowing women's adaptation into the combat forces. The programme was called AMELIA (Aircrew Modified Equipment Leading to Increased Accommodation). Under the umbrella of this initiative, several issues concerning anthropometric dimensions have been addressed, the most famous of which has been the redesign of the flight suit. The first female military pilots, namely the WASPs (Women's Airforce Service Pilots) were forced to wear flight suits that were the nearest fit in men sizes. These were often ill-fitting and no alternative was available or proposed.

The Human Systems Centre, which has its headquarters at Brooks Air Force Base in Texas, designed the new women's proportional flight suit, dubbed the CWU-27/P. This flight suit allows for a better fit around the hips and shoulders and has a zipper which is two inches (five centimetres) longer than that of the men's suits (Hutchins, 1998).

3.2.2 Physiological considerations

3.2.2.1 Tolerance to thermal extremes

Cold conditions are often experienced in aviation, and particularly in survival situations. According to research, females tend to tolerate cold environments better than males, possibly due to their greater than average fat cell storage. Females contain on average 25 per cent fat whilst men only contain 15 per cent. These figures tend to remain, even with physical training. Females therefore have greater buoyancy, insulation and energy stores compared with males, and are better prepared physiologically in a cold survival situation, and especially at sea (Sperryn, 1983).

With regard to heat, men have demonstrated a greater work capacity. Women, on the other hand, sweat less than men and therefore conserve their water stores more effectively. According to Smart (1998), the negative side effect to the latter is that females have been shown to react more severely when exposed to hot environments. Little difference between the genders exists once acclimatisation has taken place.

3.2.2.2 The effects of g-forces

Aerial manoeuvring requires significant g-tolerances, especially in combat flight. Centrifuge studies by Gillingham, Schade, Jackson and Gilstrap exposed 102 women and 139 men to rapid onset runs of up to +7Gz and gradual onset runs of up to +8Gz (Waterman, 2001:1).

Unpaired t-tests revealed that there were no significant differences between women and men in either relaxed or straining g-tolerance. Covariance analysis controlling for differences in tolerance due to age, weight and activity status revealed that women have a marginally lower tolerance (Barker, 1999). However, the study identified height as having a strong negative influence on g-tolerance. When women were matched only by height to the men in the comparison group, the women's mean g-tolerances were significantly lower than those of the men.

In addition, a later study that examined retrospective data reported a significant difference at higher levels of g. Two possible reasons were suggested for this phenomenon; the first being that women generally have reduced body strength compared to males and therefore have difficulty sustaining anti-g straining manoeuvres, particularly at high g. The other reason was said to be that the g-suits fit the women test subjects inadequately as they were designed for use by men (Barker, 1999).

According to Smart (1998:2), further studies were conducted where eight female subjects wore custom fitted g-suits. Their test scores were compared to those of ten male subjects who were also outfitted in g-suits. The comparison demonstrated no significant differences to fatigue between the genders.

The study also examined performance across the menstrual cycle in women on the oral contraceptive pill. It had been suggested that the theoretically increased vasodilatation seen as a result of an oestradiol surge during the mid-follicular phase may have resulted in a slightly reduced tolerance. However, no significant difference was noted.

Smart (1998:3) further states that some studies showed potentially damaging effects of oscillatory motion on breast tissue; however, breast discomfort was not reported in centrifuge studies and there is no evidence that unidirectional motion is likely to cause long-term damage.

The studies by Gillingham *et al.* (1986:57) deliberately screened out women with pre-existing gynaecological conditions. Two of the 24 women, however, reported urinary incontinence whilst undertaking an anti-g straining manoeuvre. This symptom was not reported in men.

The effects of g on the uterus in older women and on *in situ* intrauterine devices have not been sufficiently studied.

3.2.2.3 Hypoxia

Hypoxia can be defined as a state of oxygen deficiency in the body, which is sufficient to cause an impairment of function. Hypoxia is caused by the reduction in partial pressure of oxygen, inadequate oxygen transport, or the inability of the tissues to use oxygen.

The most hazardous form of this to aviators is Hypoxic Hypoxia, which is the reduction in the amount of oxygen passing into the blood. It occurs when the arterial partial pressure of oxygen is reduced so that the blood leaves the lungs without its haemoglobin being fully saturated (GKT School of Biomedical Sciences, 2000). It is caused by a reduction in oxygen pressure in the lungs, by a reduced gas exchange area, exposure to high altitude, or by lung disease (USAF, 1998).

Symptoms of hypoxia vary greatly from person to person. The Aeromedical Institute (Hyperbarics, Inc., 2002) describes typical symptoms such as tingling, numbness, loss of colour vision, flushing, headache, loss of muscle co-ordination, agitation, lethargy, unconsciousness, forgetfulness, cognitive impairment, inability to respond to emergency situations and the misinterpretation of instructions and/or instruments.

Hypobaric (altitude) chambers are commonly used by the military and organisations such as the FAA to create environments that simulate higher altitudes. The onset of hypoxia usually occurs at altitudes of 10 000 feet (3 048 metres) and hypobaric chambers can simulate altitudes up to 43 000 feet (13 106 metres) (though training usually occurs at 25 000 feet – 7 620 metres) (Aeronautical Management Technology, 2001:1). As the Time of Useful Consciousness (TUC) and Effective Performance Time (EPT) varies, depending on the level of altitude exposure and physical exertion, it is important that pilots and flight crews are aware of individual hypoxic effects on performance. The recognition of the onset of hypoxia and the process of putting on an oxygen mask allows for immediate recovery and the maintenance of individual control.

According to Smart (1998), females have smaller values across a wide range of lung parameters and generally have smaller lung capacities than males. Females have reduced

haemoglobin and therefore reduced oxygen-carrying capacity, yet women live at sea level under normal circumstances and have similar coping capacities to males.

Most studies in this field have been conducted in mountaineers and therefore pertain to chronic hypoxia. The studies have demonstrated no real differences between the genders in terms of overall acclimatisation, but slight differences in response were noted. Women appeared to tolerate chronic hypoxia better and to be less susceptible than males to the symptoms of acute mountain sickness (Smart, 1998).

3.2.2.4 *Motion sickness*

Motion sickness has been defined as a condition the symptoms of which are pallor, sweating, nausea and vomiting in response to a perception of real or apparent motion to which a person is unfamiliar. Squadron Leader David G. Newman of the Royal Australian Air Force is of the opinion, however, that this definition is a misnomer. He argues that a more accurate term for motion sickness should be that of 'motion maladaptation syndrome' (Newman, 1998).

In humans, movement is inferred by three principal sensory systems, namely the visual sense and the two components of the vestibular system of the inner ear. This system includes the semicircular canal which detects angular acceleration, and the otolith organs, which sense translational acceleration (Gahlinger, 1999). As the flight environment involves movement around a three-dimensional axis, and often occurs with more than one motion, it is particularly well suited to the development of motion sickness.

It is widely accepted that motion sickness is caused by conflicting inputs between the visual and vestibular systems, or between the two vestibular systems, and the comparison of those inputs with the individual's expectations derived from previous experiences (Gahlinger, 1999).

Several studies have shown that women are more susceptible to motion sickness than men, regardless of age (Antuñano, 1997:1). A male to female ratio of 3:5 has been calculated and this gender difference seems to be further aggravated by the use of oral contraceptives, menstruation and pregnancy. This leads to the deduction that hormonal factors are an aspect that affects the increased effects of motion sickness (Gahlinger, 1999).

Smart (1998:3) also reports that another reason for the difference between male and female susceptibility to motion sickness is that females are more likely to experience conflicting perceptual cues in field dependence, that is, when an individual is in an unstable environment, for example when an individual is stationary in a moving environment.

Motion sickness is a significant problem in flight training. Newman (1998) states that during World War II, an overall incidence rate of 11 per cent in trainee pilots with motion sickness accounted for 52 per cent of failures.

Even though susceptibility to motion sickness is important in the selection of potential aircrew, it does not necessarily preclude a candidate from flight training. If a candidate fails to adapt to the motion environment, he/she is able to undergo motion sickness desensitisation. This training usually achieves a positive result. The higher incidence of motion sickness in females should thus not disqualify all potential female aviators; instead, it should be managed on a case by case basis, regardless of gender.

3.2.3 Medical issues

Some medical conditions, such as migraine, urinary tract infections and varicose veins are more common in women. However, women have a lower incidence of serious and potentially permanently debilitating illnesses such as heart disease (Smart, 1998).

Generally, a woman may be deemed unfit to fly if there is a risk that one or more of the following 'conditions' could occur (Aerospace Medicine and Human Factors, 1991):

- sudden incapacitation, especially due to severe pain or the collapse of an essential organ system;
- annoyance, disturbance or distraction sufficient to interfere with the safe conduct of flight responsibilities;
- restriction of free movement or the use of equipment based on normal ergonomic design;
- dangerously altered mental function; and/or
- inconvenience resulting in reduced effectiveness in flight.

3.2.3.1 *Menstruation and menstrual disorders*

Once a month, women of childbearing age normally menstruate for four to six days. *Dysmenorrhoea* (menstrual cramps) is the most common of the menstrual cycle symptoms and may be categorized as mild, moderate or severe. Dysmenorrhoea may be both responsive and non-responsive to treatment. Regular exercise has been demonstrated to reduce the frequency and severity of menstrual cramps, probably through the release of internal beta-endorphins. Birth control pills (discussed in Section 3.2.3.2) is also an effective treatment of dysmenorrhoea in that it blocks ovulation and reduces the amount and duration of bleeding (Hughey, 1997).

While mild or moderate dysmenorrhoea may not impede a woman's flying status, severe dysmenorrhoea should be considered on an individual basis and may be adequate cause for advising a woman that she is unfit to fly while suffering from dysmenorrhea.

Another symptom associated with menstruation is the occurrence of headaches, which can present in a number of ways.

- *Menstrual migraine headaches* are common and may be temporarily disabling and may impede a woman's flight status. Menstrual migraines usually occur just before the onset of a menstrual flow or during the first day, and they are triggered, in susceptible individuals, by the sudden drop of hormones accompanying the particular menstrual phase.
- *Sinus headaches* may become more prominent during the days leading up to the menstrual cycle due to changes in hormone levels and their impact on sinus mucosa and fluid retention. These headaches have their locus of pain in the paranasal sinuses, which become sensitive to direct and digital pressure and also by the indirect pressure of putting the head down between the knees (Hughey, 1997). This is particularly relevant to female pilots who have to perform high g-aerial manoeuvres.
- *Tension or stress headaches* may worsen or improve, depending on the menstrual cycle. Hormone changes or fluid retention play a role in the development of such headaches in susceptible individuals.

Perhaps the best-recognised symptom of menstruation is the onset of *depression* and *irritability*. It is not scientifically known why some women experience mood changes with the onset of their menstrual flow, although the process of ovulation is suspected. For most women these symptoms are mild or absent; however, some women experience moderate

to severe symptoms. Usually depression or irritability begins around the time of ovulation and persists until the start of the menstrual flow.

About 80 per cent of women with moderate or severe premenstrual mood changes will attain noteworthy relief from the use of birth control pills. Anti-depressant medications such as Prozac are also effective in improving the mood changes associated with premenstrual syndrome (women who respond to anti-depressants are not those who belong to the same 80 per cent who benefit from birth control pills) (Hughey, 1997). The prescription of anti-depressants may, however, affect flight eligibility and this should be determined on an individual basis.

Other symptoms of menstruation include *breast pain, fluid retention and abdominal bloating*. Unless these symptoms are extremely severe, they should not affect a woman's flight status.

3.2.3.2 *Oral contraceptive pill*

In addition to the oral contraceptive pill's effectiveness in preventing pregnancy, it also generally

- causes menstrual cycles to occur regularly and predictably;
- shortens menstrual flows;
- lightens menstrual flows;
- reduces menstrual dysmenorrhoea;
- reduces painful ovulation;
- reduces premenstrual symptoms;
- reduces cyclic breast pain;
- reduces the risk of benign breast disease;
- reduces the risk of iron deficiency anaemia;
- reduces the risk of ovarian cysts and cancer;
- reduces the risk of uterine cancer and fibroid tumours;
- reduces the risk of symptomatic endometriosis; and
- reduces the risk of pelvic inflammatory disease (Hughey, 1997:1).

The oral contraceptive pill is cleared for use during flight, despite its potential side effects such cardiovascular problems, including stroke, heart attack, thrombo-phlebitis and thrombo-embolism. The risk of vascular complications is heightened if a woman who takes

the pill is also a smoker (Aerospace Medicine and Human Factors, 1991). The Australian Defence Force, and indeed many other air forces, consider the risks as acceptable; however, a ground trial of one month is usually required to eliminate the possibility of other systematic effects.

3.2.3.3 *Pregnancy*

According to the American Society of Aerospace Medicine Specialists, pregnancy is a physiological state and not a disease, but the associated changes in anatomy require aeromedical attention due to the increasing number of female pilots (Aerospace Medicine and Human Factors, 1991).

Physiological changes that may hinder the safe operation of an aircraft include the following:

- Nausea and vomiting in early pregnancy occur in 30 per cent of all pregnancies and can cause dehydration and malnutrition.
- Approximately 15 per cent of embryos abort in the first trimester.
- Cardiac output rises in early pregnancy, accompanied by an increase in stroke volume, heart rate, and plasma volume.
- Adequate diet and supplementary iron and folic acid are necessary, but self-medication and prescribed medication should be avoided.
- Haemoglobin and haematocrit begin to fall between the third and fifth month and is lowest by the eighth month of pregnancy.
- The incidence of venous varicosities is three times higher in females than in males and venous thrombosis and pulmonary embolism are among the most common serious vascular diseases occurring during pregnancy.
- As the uterus enlarges, it compresses and obstructs the flow through the vena cava.
- Progressive growth of the foetus, placenta, uterus, and breasts and the vasculature of these organs leads to an increased oxygen demand.
- Increased blood volume and oxygen demands produce a progressive increase in workload on both the heart and lungs.
- Hormonal changes affect pulmonary function by lowering the threshold of the respiratory centre to carbon dioxide, thereby influencing the respiratory rate.
- In order to overcome pressure on the diaphragm, the increased effort of breathing and hyperventilation leads to greater consciousness of breathing and possible greater oxygen consumption.

- The effects of hypoxia at increased altitude further increases the ventilation required to provide for increasing demands for oxygen in all tissues (Aerospace Medicine and Human Factors, 1991:4).

Simply put, aeromedical concerns can be considered in two separate categories: the effects of pregnancy on the ability to perform in-flight duties and the effects of the aviation environment on the foetus.

The risks of a female pilot's being deemed medically unfit to fly are especially high in the first trimester, due to the risk of early spontaneous abortion, ectopic pregnancy, and morning sickness. The embryo is especially delicate during this phase of development.

- *Hypoxia* in this stage has produced foetal malformations in animals. Humans, however, may only be exposed to mild hypoxia during normal flight operation and there appears to be no evidence to suggest concerns at these levels.
- *The effects of g* on the foetus have not been established, but placental blood flow and placental integrity may be a matter of concern.
- *Exposure to radiation* and aviation toxins create concerns for foetal malformations and a possible increased risk of neoplasms in childhood.
- Vibration studies have shown negative effects on animal embryos (Smart, 1998:5).

Rotorcraft are particularly noisy and provide sustained low frequency, whole body vibration; foetal noise exposure is only modestly dampened inside the mother's abdomen. For these reasons, the United States Air Force and Army bar pregnant women from helicopters during pregnancy (Hawley-Bowland *et al.*, 2001).

The second trimester of pregnancy is relatively low risk; however, anaemia and fatigue may become prevalent. Ergonomic issues such as flight suit fit and safety equipment become a concern, but the overall risks are minimal for the foetus during this stage.

The third trimester presents increased risks that include premature labour and delivery. In addition, psychological distraction is known to become an increasing concern as the pregnancy progresses. Naturally, ergonomic issues are exaggerated during this phase (Aerospace Medicine and Human Factors, 1991).

The United States military generally grounds all pregnant aircrew from fixed wing airframes during the first and third trimesters. Aircrew of ejection seat aircraft and rotorcraft are grounded for the duration of the pregnancy (Hawley-Bowland *et al.*, 2001).

3.2.4 Cultural issues

'There are political, patriarchal, religious, and misogynistically stupid reasons to preclude women but they all belong in The Museum of Natural Idiocy next to chastity belts, urban legends, homophobia, promise creepers, senile senators, proselytising preachers, and military machismo.'

(Captain Barbara A. Wilson, 1996:1)

3.2.4.1 Unit cohesion

An argument that is often cited to preclude women from flying in combat units is that their presence will affect the unit's cohesion, or 'squadron bonding' and therefore reduce mission effectiveness. Unit cohesion and morale depend on the strong bonding ability of its members (Bateman, 1998). The argument raised is that many men will consider the presence of women upsetting, which will affect the delicate balance by introducing the issue of sex and thus damage the essential bonding fabric.

The fact that this has not happened in squadrons in the last ten years has done little to dispel the myth. McGlohn, King, Butler & Retzlaff (1997:68) conducted a survey amongst USAF pilots and found that 97 per cent of males and 98 per cent of females felt comfortable flying in combat with both genders. Also, 77 per cent of males and 74 per cent of females believed that squadron mission effectiveness was not altered by mixed gender flights.

3.2.4.2 Prisoner of war

Another reason that has been argued as to why women should not participate in combat missions is the possibility that a combatant can become a prisoner of war. The gist of the argument is that women will suffer sexual abuse as well as customary abuse as prisoners of war (Bateman, 1998).

Colonel Rhonda Cornum, the only former Prisoner of War still on active duty in the United States Army states that historically, the risk of being taken a prisoner of war has been

slight but real in all conflicts (Cornum, 2001:1). She believes that the emphasis on female sexual abuse is primarily cultural and that this emphasis is derived from concerns about potential psychological after-effects of sexual abuse, and that this is based on the model of civilian women. Cornum believes that it is important to recognise that sexual abuse in the context of Prisoner of War is very different from a civilian environment and lists the following reasons:

- Women in the military are not necessarily representative of the 'average' woman. A military career is still not considered a traditional path for women, and women who choose a military career may have a different 'willingness to take risk' than women in the general population. They may not react like the 'average' woman in the civilian setting.
- Most women in the military recognise that they are engaged in a high-risk occupation, and accept that there is a small but real risk of death and capture.
- Women in the military may have different priorities. She lists the example where she was captured after being wounded by small arms fire and involved in a significant aircraft shoot-down. Her primary concerns were first those that were life-threatening (bleeding and internal injuries), followed by those that could result in permanent disability (multiple bone fractures in her case). She states that while she was subjected to an unpleasant episode of sexual abuse during her captivity, it did not present a threat to her life, limb or chance of being released, and therefore it occupied a much lower level of concern than it might have under other circumstances (Cornum, 2001:1).

Major Sandra L. Bateman argues that the Prisoner of War concern tends to be raised for sheer emotional impact and that if the authorities that claim to be so concerned about the physical well-being of women really were concerned, they should address the thousands of cases of rape and spousal abuse that occur annually and should not wait for a war to do so (Bateman, 1998).

Cornum concludes that most former Prisoners of War usually recover fully from the physical and psychological stresses and that many prisoners of war find a lasting emotional strength from their experience (Cornum, 2001:2).

3.2.4.3 *Protective instincts*

It is also felt that in operational combat the male members of a unit will be more protective of the female members in both combat and/or capture situations. History has cited countless examples of soldiers risking their lives for the lives of their team members. One would therefore hope and expect that this level of concern would be extended to female counterparts.

3.2.4.4 *Public perceptions*

One of the main concerns expressed by governments when deliberating on the issue of women in combat is fear of public reaction to women returning home from war in body bags. Today, women join the military for the same reasons that other females become fire fighters and policewomen; they have the ability to do the job and wish to serve their country.

Bateman argues that governmental concerns of this nature are ludicrous and lists a recent tragedy as example: 'When Christa McAuliff and Judith Resnik were killed in the Challenger disaster in 1986, the country mourned their deaths equally with [that of] their five male crewmembers. It was interesting to note that Christa received a great deal more attention because she was a civilian observer, while Judith received virtually no special attention for being a female crewmember. Despite the known dangers, 'society' has not called for restrictions to be placed on future space launches requiring male only crews' (Bateman, 1998:2). Bateman insists that there needs to be a shift in paradigm from thinking of a female soldier as someone's daughter to thinking of her as a military professional who is trained to defend her country.

3.2.5 Conclusion

Women are essentially different from men in many ways. However, many of the physical concerns can be addressed by re-engineering, whilst physiological differences in flight require more research. Providing and planning for medical issues and education regarding such medical issues can largely overcome medical fears. Culture is a dynamic entity and is always changing. The inclusion of women in aviation should be addressed in courses such as Crew Resources Management (CRM) and Human Factors in Aviation. It seems that there is no empirical reason why women should not participate in aviation today.

3.3 ADDITIONAL RESEARCH ADDRESSING WOMEN IN AVIATION

Several additional studies have been undertaken by various sources. Militaries, airline companies and educational institutions are interested in the dynamics of and comparisons between genders in flight. Applications are widespread and generally contribute to CRM, Ergonomics and Human Factors in Aviation, as well as the formation of policies and procedures. The research also has the very important application of addressing and dispelling some of the antiquated attitudes, stereotypes and prejudices associated with female aviators.

3.3.1 The Congressional Inquiry into the WASPs of 1944

As soon as the WASP (Women's Airforce Service Pilots) programme was put in place, Congress and military leaders wanted to know what effects it would have in the military and on male pilots. Colonel William Tunner asked Nancy Harkness Love to conduct a survey that addressed some of these issues. The survey focused primarily on male antipathy, favouritism and assignment delegation.

The questions and statements in the Congressional Inquiry and the responses to them are summarised below:

- Is there resentment among male pilots?

Survey response:

Resentment does exist amongst a minority of the Ferrying Division male pilots against the WASPs. This minority is, however, quite virulent. It is not believed that resentment exists among the supervisory or operational personnel whose sole interest is the efficient performance of the ferrying mission. These personnel are familiar with the pilot shortage in the Ferrying Division and appreciate the WASP's contribution.

- Favouritism is being practiced in giving WASP's more opportunity to fly than the male pilots.

Survey response:

This statement is incorrect in the Ferrying Division. WASPs flying time to date has consistently averaged less than flying time of male pilots.

- Do WASPs take their turn as to frequency and type of assignments? If so, how is this controlled?

Survey response:

WASP pilots take their turns as to frequency and type of assignment. WASPs are formed into squadrons just as our men pilots. Assignments to ferrying duty are awarded to squadrons consistent with their daily pilot strength and a careful survey reveals that there is not any partiality shown towards WASPs in providing them with greater frequency in delivery. Normally, any pilot in the Ferrying Division, including the WASPs, who has returned to his base is placed in the bottom of a roster consistent with the type of aircraft he is qualified to fly, and ferrying missions are assigned to the individual who has been longest at the base.

- Male pilots sit on the ground for days while WASPs get assignments and are kept busy.

Survey response:

This statement is inaccurate. All ferrying pilots have been used without anyone waiting an undue length of time for assignment. For several months past, the Ferrying Division has been extremely busy in its domestic operations, and all pilots, regardless of sex, have been utilized without anyone waiting an undue length of time for assignment. It is to be noted, however, that frequently some pilots are qualified only on a few types of aircraft and, due to a shortage of transition planes to qualify them on advanced types and due to natural inability to advance rapidly, must sit on the ground while other pilots who are well qualified on many types are of much more value in the ferrying mission and hence fly more types of aircraft. This is true amongst the WASPs just as it is amongst some male pilots.

(Douglas, 1991:118).

It is obvious from this survey that Congress was primarily concerned with the male pilots' welfare. Having female aviators in the ferrying division was fine as long as they did not impede on 'male territory'. Nancy Harkness Love and her WASPs knew that they had to play a political game in order for the programme to continue successfully.

On 10 April 1944, the survey was presented in a memorandum to Colonel William Tunner and General HAP Arnold.

3.3.2 A question of 'the Right Stuff'

When considering military pilots, professional airline pilots and even some private pilots, one often imagines a pilot's possessing 'the Right Stuff'. However, more often than not, when one thinks of this mythical paradigm, the image one conjures up is that of a *male* pilot. Hollywood has done much to reinforce this image with films such as *The Right Stuff*, *Top Gun* and *Air Force One* and one rarely comes across a film depicting a female pilot in a heroic role.

In 1997, McGlohn, King and Retzlaff set about investigating the real meaning of 'the Right Stuff', as well as whether male and female pilots in the United States Army and Air Force possess these qualities (McGlohn, King & Retzlaff, 1997:695).

The typical lay impression is that 'the Right Stuff' personality is one of extreme confidence, assertiveness and competitiveness. However, Retzlaff and Gibertini (1987:283) found three distinct personality types among student United States Air Force pilots, and discovered that only one of the three personality types was consistent with 'the Right Stuff' image.

McGlohn, King and Retzlaff (1997:695) used the NEO Five Factor Inventory (NEO-FFI), a survey of normal-range personality functioning within a big five (neuroticism, extraversion, openness to new experiences, agreeableness and conscientiousness) framework. The NEO-FFI is highly reliable (with coefficients between 0.76 and 0.90) and highly valid (with a correlation against underlying factors of between 0.75 and 0.89).

A total of 112 United States Air Force pilots (48 women and 64 men) assigned to aircraft requiring a crew participated in the study. The female pilots were compared to both male pilots and a female comparison group. Results found that female United States Air Force pilots scored higher on Extraversion, Agreeableness and Conscientiousness than either the male pilots and the female comparison group. Male pilots scored lower on the Neuroticism and Openness scale than the female comparison group.

McGlohn, King and Retzlaff (1997:697) concluded that male and female pilots in the United State Air Force have quite different personalities and that, while male pilots are apt to be characterised as 'hot shots' and possess an egocentric 'right stuff' streak, female pilots appear to have more moderate personalities. They also state that military aviation

has changed from the days of dog fighting to modern, multi-crew, highly co-ordinated missions, and that in these environments, higher levels of extraversion, agreeableness and conscientiousness are extremely valuable.

It is evident that this study is applicable in Human Factors in Aviation research. More and more women are becoming captains and first officers in commercial airlines. These career choices require that women become not only expert aviators but also assume a position of authority over several crewmembers. Just as in the military environment, higher levels of extraversion, agreeableness and conscientiousness will prove to be very important personality traits.

3.3.3 Gender, sleep deprivation and flight performance

Another military study that can be applied in the civilian environment is the study of gender susceptibility to sleep deprivation and its effects on flight performance.

Caldwell and Caldwell (1996:1) have determined that gender differences in intelligence, hearing and vision are negligible under normal flight conditions but they wanted to examine whether male and female pilots would be affected differently by sleep deprivation. Twelve (six male and six female) UH-60 Blackhawk pilots were tested at the United States Army Aeromedical Research Laboratory (USAARL). The pilots were comparable in both age and flight experience. Each subject was required to complete Profile of Mood States (POMS) questionnaires as well as simulator flights. The POMS questionnaire is a 65-item test that measures affect or mood on six scales: Tension-Anxiety, Anger-Hostility, Depression-Dejection, Vigour-Activity, Fatigue-Inertia, and Confusion-Bewilderment. Low-level navigation and upper-air work manoeuvres under instrument conditions were flown in the Automatic Flight Control System (AFCS) and pilots were required to maintain precise control over several parameters (heading, altitude, airspeed and so on).

Subjects were given three training sessions on simulator flights and the POMS. After training, subjects went to sleep at 23h00. The continuous wakefulness period began at 07h00 and sessions were held at 09h00, 13h00 and 17h00, and a POMS was administered at 23h40. Sleep deprivation testing occurred at 01h00, 05h00, 09h00, 13h00 and 17h00 with a final POMS administered at 22h25.

After analysis of the data, Caldwell and Caldwell (1996:4) determined that the flight and mood data showed no practically significant differences between males and females. The POMS data did reveal that males were more tense and anxious than females. Females felt more vigorous than males throughout sleep deprivation; however, this did not translate into superior performance. The effects of sleep deprivation on flight performance were consistent with the effects of sleep loss on subjects' self-reported mood states and the subjects thus had fairly accurate perceptions of their own alertness difficulties as the sleep deprivation progressed.

The advent of longer transcontinental commercial flights makes this type of research very important. Preliminary studies show that there is no significant difference between genders when sleep deprivation is applied to flight performance. Scientific studies such as the one conducted at USAARL do much to abolish prejudices such as the one holding that women do not possess the necessary endurance to complete long and exhausting flights.

3.3.4 Gender and pilot-controller communications

All pilots, from private pilots to combat pilots, male and female, must use radio communications. Pilots and air traffic controllers form a unique speech community in the sense that they are a group of people who routinely and frequently use a shared language to interact with each other (Shames & Wigg, 1990:17). Within this community, miscommunication often occurs on a regular basis. Research tells us that male and female communication is very different.

While the average male's voice is lower in pitch than the average female's voice, women use a wider range of pitches. Male language is more direct, while females use language that contains greater imagery (Weiss, 1993:53). Social influences also dictate that men talk more than women and that men are more likely to interrupt during conversations than women. Tannen (1990) suggests that men use speech to establish status and a hierarchy of superiority. They are more comfortable giving information and advice than accepting advice or information. Women are less comfortable in the role of information conveyer. Men talk to inform; women talk to connect.

Mary Ann Turney (1996:87) set out to determine whether gender is a factor in pilot/controller communication and developed and validated a pilot/controller survey that was distributed to 124 pilots and 133 air traffic controllers. Turney found no significant

difference at the 0.5 level between the responses of controllers and pilots, but some individual responses did suggest trouble understanding the female voice. Turney attributes this to pitch differences, volume, and/or social expectations. She further concluded that expressions of preference for male controllers during busy times correlate with research suggesting that men are expected to be in control of linguistic situations while women are expected to be more hesitant, less decisive and thus less effective under pressure. Respondents' belief that it is easier to communicate with male pilots correlates with research rating men as more dramatic and more direct in their speech patterns. However, agreement with the statement that it is more comfortable to deal with female controllers reflects the societal norm that women are supportive, helpful, and collaborative.

3.4 THE APPLICATION OF CRM IN ADDRESSING ATTITUDES, STEREOTYPES AND PREJUDICES WITH REGARD TO WOMEN IN AVIATION

'In a cockpit where the focus ought to be on cooperation, not competition, and where decision-making is based on developing agreement, the full participation of EVERY member of the crew is essential to increased situational awareness and reduced risk of calamity. To the extent that CRM training can address the 'styles', characteristics and attitudes of a diverse population, it will fulfil its purpose'.

(Turney, 1995:266)

3.4.1 CRM: definition and roots

In order to understand how CRM can benefit the aviation industry, it is first necessary to understand what CRM refers to. The Department of the Air Force (1998:5) defines CRM as 'a process designed to aid in the prevention of aviation accidents and incidents by improving crew performance through a better understanding of human factor concepts. It involves the understanding of how crewmembers' *attitudes* and behaviours impact safety, identifying the crew as a unit of training, and providing an opportunity for individuals and crews to examine their own behaviour and make decisions on ways to improve controller teamwork'.

CRM was developed due to the realisation that human error contributes 60 to 80 per cent of all air carrier accidents and incidents. In 1979, the National Aeronautics and Space Administration (NASA) presented a workshop that identified human error in interpersonal

communications, decision-making and leadership as the main reason for air mishaps (Helmreich, 1996:2). At this initial meeting, NASA termed its findings 'Cockpit Resource Management'. Many of the air carriers who attended this meeting left committed to developing new programmes to enhance the team aspects of flight operations.

Helmreich (1996:1-3) describes the evolution of CRM since 1979 as follows:

- *First-generation Cockpit Resource Management*
The first Cockpit Resources Management programme was initiated by United Airlines in 1981 and was developed with the aim of enhancing managerial effectiveness. The programme also included annual Line Oriented Flight Training (LOFT), where crews could practise interpersonal skills in full mission simulation without jeopardy. First-generation Cockpit Resources Management was psychological in nature and advocated general strategies of interpersonal behaviour. However, many pilots opposed initial Cockpit Resources Management courses, claiming them to be mere 'charm schools' or attempts to manipulate their personalities.

- *Second-generation Crew Resources Management*
In 1986, NASA held another workshop for the airline industry. By this time, a number of airlines had initiated CRM training and many had reported on their programmes. Second-generation CRM included concepts such as team-building, briefing strategies, situational awareness and stress management. It also addressed decision-making and breaking the chain of errors that can result in catastrophe. Many of these courses are still being utilised in the industry.

- *Third-Generation CRM*
Third-generation CRM identified aviation system inputs that may affect safety, such as organisational culture. CRM was integrated with technical training and focused on specific skills and behaviours that pilots could use to function more effectively. Programmes also began to address the recognition and assessment of human factors issues.

- *Fourth-generation CRM*

In 1990, the Federal Aviation Administration (FAA) introduced the Advanced Qualification Program (AQP), which is a voluntary programme that allows air carriers to develop innovative training that fits the needs of the specific organisation. In exchange for greater flexibility in training, carriers are required to provide both CRM and LOFT for all flight crews and to integrate CRM concepts into all aspects of technical training.

- *Fifth-generation CRM*

Currently, fifth-generation CRM falls under the umbrella of Error Management. It illustrates the limitations of human performance and advocates a culture-free approach, in that it focuses on error management, which creates a universal rationale that can be endorsed by all pilots.

Over the past 25 years, CRM research has done much to change attitudes and behaviour among flight crews and these changes have led to a vast increase in the margin of safety in flight operations.

3.4.2 CRM core concepts

Research and development on CRM has assisted the FAA in designing a very comprehensive training programme for pilots and air traffic controllers. This training focuses on nine CRM core concepts, namely Situational Awareness, Effective communications, Mission planning, Group dynamics, Risk management, Human factors, Workload management, Stress awareness and Decision-making (Department of the Air Force, 1998). The most important of these concepts are briefly discussed below.

3.4.2.1 Effective communications

Effective communication is not only very subjective, but varies in different situations. Sometimes individuals do not communicate at all, at other times they do not communicate enough, and often communications are performed incorrectly. CRM communication training is aimed at improving communication skills. The successful transfer of information is a multifaceted process that requires information to be conveyed when it is needed, that it is transferred clearly, attended to, understood, acknowledged by the receiver, and

clarified if necessary. Communication malfunctions occur in one of three communication components: the sender, the message or the receiver.

Miscommunication by the *sender* can have various reasons. The Department of the Air Force (1998) lists the most abusive of these to be an intentional withholding of information for an unknown 'hidden agenda'. More commonly, ambiguous wording or the use of jargon is to blame. Additionally, distractions that occur while the sender is trying to communicate will inhibit the effectiveness of the message.

Regardless of the abilities and intentions of the sender, the *message* can often be vague, overly complicated, or difficult to interpret or remember.

The *receiver* must also practise effective listening skills on a continuous basis by hearing, interpreting, evaluating, responding, or asking for clarification if a communication is unclear.

Specific aviation factors may also block, distort, or change the meaning of a communication. Physical barriers such as background noise, headsets/hand-held phones, or multiple/simultaneous communications can inhibit pilot/controller interaction. Non-standard phrases may also inhibit effective communication.

The Department of the Air Force (1998) suggests that the best time to promote effective communications is during the preparation (briefing) phase where a free flow of information between crew members should be established.

3.4.2.2 *Group dynamics*

Group dynamics, as related to CRM, focuses on leadership, command authority, responsibility, assertiveness, behavioural styles and team building.

- Leadership is a significant factor in a crew's success or failure. The Department of the Air Force (1998:22) defines a leader in a given situation as 'a person whose ideas and actions influence the thought and the behaviour of others. Leaders are an agent of change and influence (both positive and negative), using examples and persuasion combined with a personal understanding of the goals and desires of the group. Leaders must be able to contribute to solving problems of the group, whether directly

or indirectly'. Strong leadership creates a high level of crew involvement and shared commitment to overcome obstacles as a team. Every member of a crew must recognise his/her position within the team – leadership does not occur in a vacuum.

- Conflict resolution skills are required by crew members as often different personalities and situations may lead to disagreements. CRM teaches crew members the necessary skills to deal with a conflict situation, as this is fundamental to good problem-solving. Furthermore, it leads to deeper thinking, creative new ideas, mutual respect and higher self-esteem, all of which strengthen team effectiveness.

- Team building will occur without effort in a normal group environment when a common cause is being pursued. To enhance the process, each person on the crew can be open to certain characteristics and group dynamics. As more individuals become positively group-oriented, others will be influenced, and changes in attitudes will occur. However, often negative behaviours occur within a group, resulting from problematic attitudes. These behaviours are manifested in hazardous attitudes, team degradation, performance incidents, or mishaps. Negative attitudes such as the Halo Effect and Excessive Professional Deference are discussed in depth in Chapter Four.

3.4.2.3 *Situational awareness*

A loss of situational awareness is one of the largest contributors to human performance-related mishaps. The Department of the Air Force (1998:9) defines situational awareness as 'the accurate perception of current operations, other controllers, aircraft, and the surrounding world, both now and in the near future'.

Situational awareness involves interpreting situational cues through sensory channels (hearing, seeing, touching, tasting and smelling) to recognise whether there is a problem that may require a decision to be made or some action to be taken. Errors in situational awareness can be the result of not receiving information, a failure to perceive information, improper comprehension of information, or the inability to project actions. The Department of the Air Force (1998) reports that most mishaps result from a series of poor decisions (the ability to make a correct decision is based on the acquisition of appropriate information, accurate assessment of the information, accurate judgement of the probability of events, and risk assessment based on the three previous elements) and that each error leads to an increase in the workload required to rectify the error.

Causes and threats leading to a loss of situational awareness may include

- *Attention threats:* These occurs when a person's conscious level of awareness is distracted, when too many tasks are present to manage, or when the controller fails to monitor the environment.
- *Channelised attention:* This refers to focusing on only a limited number of environmental cues while excluding others of possibly higher importance/priority.
- *Distraction:* This is the interruption of conscious attention to a task by a non-task-related cue.
- *Habituation:* This describes the adaptation and subsequent inattention to a cue or warning sign. Habituation can occur when there is a high workload, a change in the operating position layout, or a lack of recent experience resulting in a wrong prioritisation of cues.
- *Negative transfer:* This occurs when something is learned so well that it is performed at a subconscious level; however, in a new or different situation, the old response is inappropriate (The Department of the Air Force, 1998:11).

3.4.2.4 Risk management

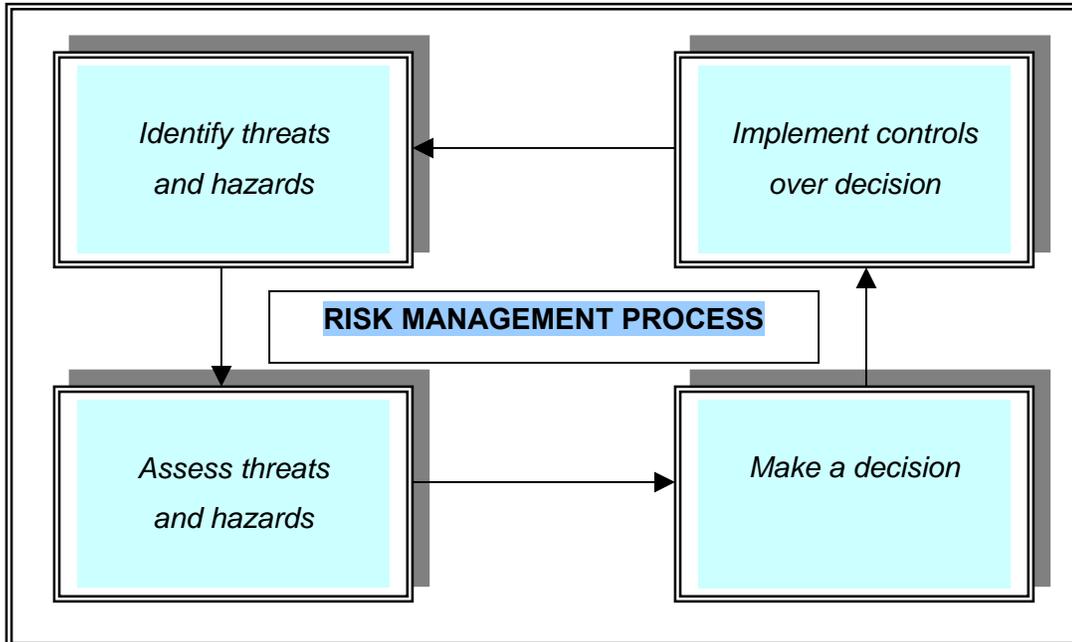
The ability to make a correct decision in a safe and timely manner depends on getting appropriate information quickly, assessing the information accurately, judging the probability of events, and assessing risk based on the three previous elements. The Department of the Air Force (1998) states that most aerial mishaps result from a series of poor decisions, known as a poor judgement chain.

Risk management is an orderly, progressive way of viewing very complex situations – it aids individuals in making appropriate decisions in order to accomplish safety in tasks. The Department of the Air Force (1998:38) defines risk management as the assessment of the likelihood of an acceptable outcome to a given decision or judgement. It further describes the process of risk management as set out in Figure 3.1 (overleaf).

Controlling bodies such as the FAA grant authority over air space to air traffic controllers and pilots in command. While group decision-making in the cockpit is always preferable, in emergency situations it may be the sole responsibility of the pilot in command to identify and assess threats and hazards and then make an appropriate decision. Aviation provides a unique environment where the risk management process is continuously put into

practice. It is important that skills pertaining to the process of problem identification and appropriate reaction is taught and re-enforced in pilots and air traffic controllers.

Figure 3.1: The risk management process



Source: Department of the Air Force (1998:39)

3.4.2.5 Stress awareness and management

An individual's ability to perform is directly related to his/her physical, physiological and emotional state. Stress is the body's response to the different demands placed on it, and these responses may affect an individual's judgement and decision-making.

The Department of the Air Force (1998:43) states that stress responses can be interpreted in three categories namely:

- *physical stress* such as heat, noise and vibration;
- *physiological stress* such as fatigue, lack of sleep and missed meals; and
- *emotional stress* such as peer pressure, marital problems, fear and anger.

Pressures resulting from stress may have adverse reactions that may include reduced decision-making ability, job dissatisfaction, reduced work effectiveness, behavioural changes or health problems.

The human body reacts to the demands made upon it in three stages. The first reaction is that of alarm, followed by resistance, and finally, exhaustion (if the demand continues). In the alarm stage, the body recognises the stressor and prepares to deal with it, either by confronting it or by fleeing. The brain stimulates the sensory system, which increases the heartbeat, the rate of breathing and perspiration. In addition, it raises blood sugar, dilates the pupils, and slows digestion. An individual may also experience a huge burst of energy, greater muscular strength, as well as improved hearing, vision and alertness (The Department of the Air Force, 1998).

The process of making a simple decision is one of the leading causes of stress. Pilots have to make decisions continuously. Usually, with flight training, stress has little impact on an individual's ability to work physically in the cockpit. It can, however, have a dramatic impact on the completion of complex tasks such as making logical decisions. A common effect of excessive stress is fixation or tunnel vision, where the pilot in command focuses on one problem to the exclusion of others. An individual loses the ability to see all the information in front of him/her, making it challenging to make sound choices from the available alternatives.

3.4.2.6 *Workload management*

Pilots must analyse, integrate, and prioritise an overabundance of information in a very short time, while under extreme pressure and stress. Proper task prioritisation increases situational awareness and allows the pilot to make optimal decisions. Prioritising actions, distributing workload and managing unexpected events are some elements involved in workload management.

The Department of the Air Force (1998:31) suggests that setting operational priorities is often a direct reflection of a crew's ability to utilise checklists. Well-developed checklists assist in training crew members with regard to how to prioritise by providing guidance on restoration priorities and steps to regain operability. The Department of the Air Force (1998:35) lists the following example of guidelines for setting operational priorities:

- *Checklists* – Consistently using well-developed checklists creates operational discipline.
- *Communication* – Talk and interact.
- *Distractions* – Ignore distractions.

- *Delay non-essential tasks* – Define essential and non-essential tasks. Prioritise essential tasks and rank non-essential tasks and perform them when times allows.
- *Delegate tasks* – Delegate tasks that other crew members can perform.
- *Critical tasks* – Identify and address critical tasks first.

3.4.2.7 *Decision-making and judgement*

Aviation is conducted within an extremely dynamic environment and, as levels of uncertainty, complexity and stress increase, at times, where there are time constraints and individuals have low levels of experience, the potential for accurate decision-making may decrease. The consequences may be immediately apparent, or the crew may be nudged along a poor judgement chain (PJC).

According to Walters (2001:2-12), a poor judgement chain is governed by two laws, namely: (1) One poor judgement increases the possibility of further poor judgements' being made, and (2) the further one goes along the poor judgement chain the less certain the safe outcome of the flight becomes. As the crew moves along the poor judgement chain, complexity and uncertainty diverge to become greater and greater; time and options converge to become less and less, and when time and options run out, control of the situation is lost.

3.4.3 **Successes and failures of CRM training**

Helmreich (1996:4) suggests the following successes and failures pertaining to CRM.

- *CRM has been validated.* CRM programmes that include Line Orientated Flight Training (LOFT) and recurrent training produce desired changes in attitudes and behaviour. Crews who have completed course evaluations report that it is effective and important training. Attitudes about flight deck management also change in a positive direction. Evaluators' ratings of human factors performance in line operations and in LOFT show significant improvement following CRM training.
- *CRM does not reach everyone.* A small subset of pilots has rejected the concepts of CRM. Some participants have shown worse attitudes after training and have failed to practise the precepts of CRM in the cockpit. These CRM failures are found in every airline and are known to their peers and to management. These individuals have

come to be known by names such as 'Boomerangs', 'Cowboys' and 'Drongos'. Efforts at remedial training for these pilots have not proved particularly effective.

- *Acceptance of basic concepts may decay over time.* Helmreich (1996:4) surveyed a number of pilots several years after they received initial CRM training and found that there was some backsliding with regard to the acceptance of basic concepts, even with recurrent training. Helmreich suggests one reason to be the broadening of training to include flight attendants and other personnel. As training evolved from one generation to the next, the original implicit goal of managing error may have been twisted to that of 'training to work together better'.
- *CRM does not export well.* As CRM training expanded, many airlines in the United States and around the world began to purchase courses from other airlines and organisations. Courses imported from other organisations had less impact than those that were developed to reflect the culture and issues of the receiving carrier. This phenomenon was further exaggerated when training courses from the United States were delivered in other nations where the concepts presented were incongruent with the national culture of the pilots.

3.4.4 Additional research pertaining to gender and CRM

Early CRM training was primarily focused on the role of the captain and the captain's responsibility for aviation safety. Current CRM has broadened to encompass the flight and aircraft crew. CRM training applies Human Factors in Aviation principles and one important aspect of this is interpersonal skills.

Turney (1995:262) is of the opinion that concepts regarding command, leadership, communication style, decision-making and shared authority have different meanings for women and for men. She explored these issues by asking the following questions: (1) How do male and female learning and leadership styles differ? (2) What barriers to gender integration and crew teamwork are perceived by pilot crew members? (3) What recommendations can be made to support improved CRM training programmes?

The research results showed that, with regard to learning and leadership styles, men were reported to be more task-oriented and exhibited more confidence, while women were reported to be better communicators and exhibited greater sensitivity to people. Turney

also found that women were reported to work harder at learning technical information to compensate for a possible lack of general mechanical training.

Barriers to women's integration in the crew team were reported by both males and females and included a lack of understanding of gender differences, males' being perceived as crew leaders and the general belief that female pilots have logged fewer flight hours than male pilots.

Feedback related to improving crew teamwork included suggestions such as improved communications (leading to better teamwork), increased situational awareness and the ability to listen and evaluate, and shared decision-making, conflict resolution and patience. These were all factors that could improve teamwork.

Turney (1995:266) concludes that cockpit crew effectiveness might be significantly reduced due to a lack of crew insight regarding the ways in which men and women learn and exert leadership and that CRM training should include instructional designs that target an increasingly diversified crew population.

3.4.5 In conclusion

CRM training is primarily directed at aviation safety. Human Factors in Aviation has done much to improve safety through the creation of a greater understanding of interpersonal differences. These differences are, however, not only limited to gender issues but also encompass differences in language, age, politics and other factors.

Though some initial research has been done in this arena, additional research such as that which follows in the subsequent chapters may do much to address unfair stereotypes, attitudes and prejudices.

3.5 INTEGRATED CONCLUSION

In 1992, the Presidential Commission on the Assignment of Women in the Armed Services determined that the requirements for strength and endurance are gender-neutral and that sensory, perceptual and psychomotor performance for men and women are similar. They further determined that there is no physiological evidence for a categorical restriction for women in combat aviation (Baisden *et al.*, 1995).

Studies at the Harry G. Armstrong Aerospace Medical Research Laboratory have proven that minimal adjustments in cockpit design would allow a larger percentage of women to fit in aircraft, especially in combat aircraft. It is ironic that this is already being done on an international scale to accommodate the anthropometrical measurements of men of different client countries, but not to include female aviators.

Additionally, the argument that women are physically weaker than men and can therefore not pilot aircraft is also no longer valid. As discussed in this chapter, the strength requirements needed to handle combat aircraft has been sufficiently lowered by the development of improved aircraft handling equipment.

While it is true that several innate medical differences exist between men and women, it is not true that one gender is better than the other in this regard. The only advantage that male pilots have in this regard is that, historically, due consideration has been given to male health aspects while female health issues are only just starting to be explored in relation to aviation.

Cultural debates such as the 'unit cohesion' issue or 'prisoner of war' concern has been largely exaggerated over time and not adequately addressed. While these attitudes and concerns are still prevalent in the argument to exclude women from combat and aviation, the arguments no longer hold water. This is an old paradigm, which is feverishly held on to by many people.

In terms of personality, studies have shown women to be more suited than men for modern aviation missions and commercial aviation, in that they display higher levels of extraversion, agreeableness and conscientiousness. In fact, the overly aggressive nature once deemed necessary for flight has very much fallen by the wayside, and has at times been blamed for a large percentage of pilot error.

In spite of all the research that has been done with regard to physical, physiological and psychological differences and similarities between males and females, many countries, such as South Africa, still limit their female pilots and prevent them from taking on combat roles. No official reason has yet been offered by the South African Air Force for this exclusion, and comment seems to be limited to the point that this issue is an 'emotive' one.

Labour laws and affirmative action have, however, done much to increase the number of female pilots in the private sector. Human Factors in Aviation is a field specifically designed to investigate and address issues that will create greater understanding between crew members. It is only through education that unfair and unrealistic stereotypes, attitudes and prejudices with regard to female pilots will be rectified.