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Fast women: Or why women who fly high performance aircraft are fast but not loose ¹

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Introduction

Women entering a male dominated sphere for the first time will always encounter difficulties. Some of these problems relate to the physical or physiological attributes of the women themselves. Others relate to the attitudes of the men whose world they wish to enter. The Royal Australian Air Force currently has its first female attempting to break into one of the last bastions of male domination left in today's military - the fast jet world.

The concept of flying women is not new. A brief look back at the history books tells us that women played a large role in the early history of aviation. Early pioneers included the Wright Brothers sister Katharine, Harriet Quimby in her purple satin flying suit who was the first woman to fly the channel, and household names such as Amelia Earhart and Amy Johnson. Australia even had it's own pioneer aviatrix, Nancy Bird, who learned to fly in 1933 at the age of 17 and flew for one of this country's earliest airborne ambulance services.

Women have also played a major part in the military in general, however, the role of female aviators in Western militaries has been an area of politics and controversy, particularly when enough men were available to do the job. Despite this, thousands of female pilots were called upon in World War 2 to fill vacant cock- pits and free men for fighting duties.

In the US, the Women Airforce Service Pilots (WASPs) based at Avenger Field, Sweet-water, Texas kept the home planes flying from 1943. Eventually, over 2,000 women flew over 70 aircraft types in non-combat roles, mostly performing ferrying, training and transport duties. Seventy of these women were killed or injured whilst flying, but it was not until 1977 that the WASPs were granted Veterans status by Congress.¹

The British kept women aviators out of uniform but had them fulfilling similar functions to the WASPs as part of the civilian Air Transport Auxiliary. It wasn't until 1952 that the first female RAF pilot, Jean Bird, a reservist, was given her full set of wings. By this time she had been flying for 20 years, had over 300 hours on 90 aircraft types and had a Senior Commercial Pilot's license. In fact, she had more experience than most of the instructors who trained her for her wings. Unfortunately, the WAAFVR, the only arm of the military in which these women could serve, was disbanded in 1957 due to an early Defence reform plan 2. The Russians were far more progressive in World War 2, allowing women to fly in a combat role and creating entire female bomber and fighter regiments.

After the war, the surplus of fully qualified male pilots meant that women, who were still unable to take on a combat role, were relegated back to their "proper" positions as wives and mothers. The one exception to this was the USSR who continued to allow women to fly and in 1962 put the first woman in space, Valentina Tereshkova.

The role of females in society gradually changed over subsequent years and in the 1970s female aviators once again began training in Western Defence Forces. In the late seventies and early eighties, the Canadians conducted the "Servicewomen in Non-traditional Roles" (SWINTER) study, culminating in the first female CF-18 pilots undergoing training in 1987. The US soon followed and now most Western militaries allow women to fly all aircraft types.

Australia lagged a little behind in this area. Some women apparently managed to slip the shackles and fly in the UK during the war with the ATA, but our first female military pilots did not graduate until 1988. Fast jets were opened to women in 1995, however, the first candidate unfortunately failed Introductory Fighter Course (IFC). In 1997 an ex transport pilot passed IFC and commenced F-111 conversion. As of August 1997, the RAAF had eight female pilots flying most aircraft types including two Qualified Flying Instructors and a test pilot. Five pilots are presently completing training at 2 Flying Training School. The RAAF also has three female navigators and several non-commissioned aircrew, including three air-borne electronics analysts, a loadmaster and a flight engineer. As a result of these small numbers, the concept of female aircrew is still a relatively novel concept within the Australian military environment.

This paper examines some of the main issues relating to these fast women concentrating on those areas where we as military health professionals may be called upon to provide support. The particular areas of concern are the four traditional arguments as to why women shouldn't be flying - their physiological differences, their perceived physical weakness, specific women's health problems, and squadron cultural issues.

Physiological Issues

"Women can't fly fast jets - their tits will sag and their womb will fall out"
Crusty Old Jet Jockey, RAAF Pearce, 1991

Hypoxia

As in many areas of female physiology, studies into the differences in response to hypoxia between the sexes have been conflicting but have overall shown little significant difference. Some differences do exist in terms of physiology. Females have smaller values across a wide range of lung parameters and generally have smaller lung capacities than males. Females also have several haematological differences including reduced haemoglobin, and therefore oxygen carrying capacity, compared with their male counterparts. However, women exist at sea level under normal circumstances with these differences and presumably have similar coping mechanisms to men when exposed to hypoxia.

Most studies in this area have been performed in mountaineers and have therefore focused on chronic hypoxia. These studies have demonstrated no real difference between the sexes in terms of overall acclimatisation although some minor differences in response have been reported.³ In fact women appear to tolerate chronic hypoxia better and have also been shown to be less susceptible than males to the symptoms of Acute Mountain Sickness.⁴ The limited studies comparing the response of males and females to acute hypoxia have shown little difference in performance between the sexes at altitude relative to their differences at sea level.⁵

Decompression Illness

Various studies have shown that women are more susceptible to Decompression Illness (DCI) compared with men, with reported increased incidences of between three and four-fold in both altitude-induced and diving DCI.^{6,7} Dixon *et al* conducted separate studies on males and females which involved exposure to a chamber altitude of 16 500 ft for 6 hours breathing a mixture of 50% N₂ and 50% O₂. These studies revealed that although more bubbles were detected in males compared with females (73% versus 43% of subjects), females experienced more symptoms (17% versus 3%). A relationship between DCI and stage of the menstrual cycle has also been reported with an apparent increased incidence early in the cycle.¹⁰ Yet another study suggested that females were more likely to present with complicated DCI.¹¹

Several reasons for this difference between the sexes have been postulated. The most popular theory is that, as females on average have increased body fat compared with males, they, therefore, have an increased nitrogen load. In addition, hormonal changes occurring with the normal menstrual cycle or due to the oral contraceptive pill may result in reduced venous tone and this may exacerbate the effects of nitrogen bubbles.

Despite these differences, DCI is still a relatively rare event in aviation, and therefore even with this increased risk, the overall risk of female aircrew developing DCI when flying is still acceptably low. The risks associated with chamber raining are however of some concern.

Effects of G

Centrifuge studies by Gillingham *et al* exposed subjects to rapid onset runs up to +7 Gz and gradual onset runs up to +8 Gzi¹². No significant differences in relaxed or straining G tolerance were noted between the sexes in this series, however, there was some evidence that there was a significant difference between the sexes when matched for height. In addition, a later study examining retrospective data did report a significant difference at higher levels of G.¹³ Two reasons were postulated for this difference. The first is that females have reduced body strength compared with males and therefore will have difficulties in sustaining an anti-G straining manoeuvre, particularly at high G. Another possible explanation is inadequate G suit fit, particularly as these garments are designed for men.

In a recent study utilising custom fit G-suits, eight females were tested and these results were compared with data on ten male subjects.¹⁴ No significant differences were demonstrated in time to fatigue between the sexes. This study also examined performance across the menstrual cycle in women on the oral contraceptive pill. It had been postulated 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.

Specific female health issues in relation to high G have not been studied despite the uninformed claims of some. Many studies have shown the potentially damaging effects of oscillatory motion on breast tissue, however breast discomfort has not been reported in centrifuge studies and there is no evidence that unidirectional motion is likely to cause long term damage. The Gillingham study deliberately screened out women with pre-existing gynaecological conditions however two of the 24 women in the study reported urinary incontinence whilst undertaking an Anti-G Straining Manoeuvre.¹² This symptom has not been reported in men. The effect of G on the uterus in older women, and on in situ intrauterine devices has also not been adequately studied to date, nor have effects on menstruation.

Tolerance to Thermal Extremes

Men and women tend to respond differently to hot environments. Some studies have demonstrated that men have a greater work capacity in heat however women sweat less than men and therefore conserve their water stores more effectively. A negative side effect of this latter difference is that females have been shown to react more severely on exposure to hot environments however there seems to be little difference between the sexes once acclimatisation has occurred.¹⁵⁻¹⁶ It has also been suggested that many of the reported differences may not be significant if subjects are controlled for physical fitness.¹⁷

Cold environments are also encountered in aviation, especially in the survival situation. Females tend to tolerate cold better than males, possibly due to their greater average fat stores. On average females contain 25% fat whilst men only contain 15% and these differences remain even with training.¹⁸ Thus females have greater buoyancy, insulation and energy stores compared with males and are therefore better prepared physiologically in a survival situation, particularly at sea. This theory was supported by Mannino and Kaufman who reported a significant decrease in core temperature drop in men compared with women when exposed to a reduction in torso temperature. However, if controlled for percentage fat (and especially fat distribution), there is probably little difference between the sexes.¹⁹

Motion Sickness and Disorientation

Studies utilising questionnaires have reported that females are significantly more susceptible than males to the symptoms of motion sickness.²⁰ A male to female ratio of 3:5 has been calculated,²¹ and this gender difference appears to be further exacerbated during menstruation.²² Differences have also been reported in rates of simulator sickness.²³

The reason for this difference is not entirely clear although hormonal factors have been proposed.²² Other factors may also be of significance including field dependence; that is, when in an unstable environment (for example when stationary in a moving environment), females are more likely to experience conflicting perceptual cues than males.²⁴ Field dependency correlates with both nausea and disorientation. This area clearly requires more study,

but is supported by the fact that males are more stable than females on tests for ataxia such as Sharpened Romberg's.²⁵ Another possible explanation is that women are more likely than males to report the symptoms of motion sickness as has been reported to be the case with other medical conditions.²²

This difference in susceptibility to motion sickness may be of significance in selecting potential aircrew, however apart from questioning for a history of significant motion sickness, screening for sensitivity is not routinely performed on aircrew applicants. If students do fail to adapt to the motion environment, they are able to undergo motion sickness desensitisation usually with good effect. Each individual is managed on a case by case basis and therefore a demonstrated increased incidence in females as a group is not viewed as a reason to bar all potential female aviators.

Physical Issues

"Men do not *believe* us capable"
Amelia Earhart, 1930s

Physical Strength

Women are, in terms of physical strength, the weaker sex. In fact, depending on the muscle group, they have only between 35 and 85 per cent of the strength of males.²⁶ This can be improved somewhat by weight training, however the effects of weight training in female student pilots has not always produced benefits. When women first began flying training in the US Navy they were scheduled extra physical training sessions as part of their curriculum. This was in fact found to be detrimental to their training as it distracted them from studies and actually produced no real benefits in terms of strength.²⁷

Both manoeuvring an aircraft and performing an anti-G straining manoeuvre in a high G environment require a high degree of muscle strength and endurance. Therefore, it would appear that a greater percentage of women compared with men will experience difficulties in this area. However, it is also true that a percentage of men will also have difficulties, particularly when flying at the aircraft limits. Therefore, in this area, as in many others, fitness to fly high-performance aircraft should be judged on a case by case basis, with the acceptance that not all people are capable of flying all types of aircraft and all types of missions.

As well as assessing the ability to fly the aircraft, several occupational health and safety considerations may be of concern due to these strength differences. These include the potential for neck injury under high G loads and the ability to initiate the ejection sequence in an emergency.

Females have decreased neck strength compared with men (60%) but have a 12% greater range of movement and 11% faster neck muscle reaction time.²⁸ As all three probably play a role in determining resistance to injury under G, the overall risk is believed to be similar for both sexes.

Ejection initiation requires a reasonable degree of physical strength however the general consensus of opinion is that most people will have the strength to initiate the ejection sequence in an emergency. Specific studies examining these issues do not appear to have been undertaken.

Anthropometry

As well as being physically weaker, females are also smaller on average than males across all parameters considered important in the cockpit. These include sitting height, buttock-heel, but- tock-knee and functional reach. There is also an interaction between size and strength, as problems of reduced strength will be compounded when maximum force is required at maximum reach. In fact it is estimated that as many as 50% of women may be excluded from flying current US military aircraft on the basis of anthropometry alone.²⁹

Women are not only smaller than men but also have different dimensions in different places. For example, females have a greater hip breadth by 5cm on average whilst males are wider across the shoulders by at least 2.5cm.³⁰ These size differences are not only important when considering fit in the cockpit and ability to control the aircraft but also with the fit of safety equipment. This includes aircrew helmets, oxygen masks, flying suits and Nuclear,

Biological, Chemical Defence (NBC) ensembles, and necessitates either changes or modifications to this equipment to accommodate these size differences.

Ejection

Concerns have also been raised regarding safety in ejection. Females have a smaller cross-sectional area of vertebrae compared with males. In addition, seat charges are designed for the male weight range and therefore female vertebrae are exposed to a greater force per unit area than those of males. This suggests an increased risk of spinal column injury in females. Evidence to support these theories is however somewhat contradictory. One study using manikins demonstrated that the risk of vertebral fractures was significantly greater with smaller mass dummies,³¹ however a statistical analysis of real-life ejection data revealed that the risks were increased in taller and heavier ejectees.³²

With modern ejection seats being designed to reduce the overall force and particularly the onset of the force to which the aviator is exposed, the overall risk for females is probably not unacceptable. Despite this, several nations do not train females on an ejection seat rig during initial aviation medicine training although the RAAF has continued to do so.

Other differences in shape between females and males may result in an increased risk of other injuries, such as fracture of the femur, however this has not been thoroughly investigated at this stage.

Also, to be examined further are the implications for the older female, particularly the post-menopausal effects on bones and the possibility of osteoporosis. Early indications are that hormone replacement therapy will be mandatory for post-menopausal women.

Solutions

Many of these physical problems can be overcome. Future aircraft are being designed to accommodate a greater percentage of the female population. An example of this is the design of the new Joint Primary Aircraft Training System (JPATS) aircraft and the F22 fighter for the US military. By order of the US Congress, the JPATS was to accommodate 95% of female pilots, however, reality will see perhaps only 80% compatibility.³³ Also, the fact that most modern aircraft these days utilise fly by wire control inputs means that the physical demands required to control aircraft are much reduced and therefore within the capabilities of a greater proportion of the population. However, this may be countered by the fact that the new generation fighter aircraft will be capable of sustaining much higher levels of G and therefore will place greater demands on the aircrew in terms of sustaining an anti-G straining manoeuvre.

Safety equipment can also be modified, and in some cases in the past this has been attempted illegally. Legal modifications in the RAAF include applying darts in the waist, thighs and calves of G-suits, and removal of links from oxygen mask suspension chains thereby tightening the fit of the mask. Illegal modifications include the use of seat padding in the ejection seat and cutting holes in helmet liners to accommodate hair buns.

As mentioned above, ejection seats have already been designed to reduce the maximum force and rate of onset of force to which the aircrew are exposed. Some seats have also been designed to tailor the force to the individual by dialling in the recipient's weight prior to take-off.

In summary most of the problems resulting from the physical differences between males and females can be solved but generally at a considerable cost. Much effort and expense is being applied throughout the world at the present time in order to accommodate females in all types of aircraft. As far as the RAAF is concerned, the extent to which these modifications will be adopted will probably depend on both the need to adhere to the principles of equality and the overall cost of the measures.

Medical Issues

"Women are temperamentally unfit to fly and prone to panic in any calamity"
Claude Graham-White, 1911

General Health

Some medical conditions are more common in women. These conditions include migraine, varicose veins, and urinary tract infections. There is also evidence to suggest that women report more symptoms and attend medical facilities more frequently than men.³⁴ However, women have a lesser incidence of serious and potentially permanently incapacitating disorders such as ischaemic heart disease.

Women's Health

Specific gynaecological problems may also compromise fitness to fly. These include menstrual abnormalities where the risk of sudden incapacitation may be of concern. Studies of female pilots before and after flight have demonstrated that flight has some influence upon the secretion of female hormones,³⁵ however the significance of this is unknown. It has also been reported that menstrual cycles in female flight attendants may become disrupted during trans-meridian flight and that a significant percentage of these individuals suffer from heavier menstrual loss whilst flying, however, most report normalisation of their cycles with time.³⁶ Effects on pilots of high-performance aircraft have not been examined.

Pre-menstrual syndrome is another problem specific to women that may produce a variety of effects, some of which may be of significance in the aviation environment. Symptoms include pain and discomfort, oedema, abdominal bloating, nasal and sinus congestion, increased incidence of migraines, and psychological effects such as general irritability. The latter may not necessarily be a disadvantage, as few pilots would want to go into combat against an ace fighter pilot with PMT! However, there is some evidence that increased rates of accident proneness occur during this stage of the menstrual cycle.

The most important aspect when considering these specific women's health problems is that they should be managed in a similar way to any other medical problems which may impact upon flying safety and operational effectiveness.

The conditions should be screened for at recruiting, and trained aircrew suffering from severe symptoms or incapacitating conditions should be grounded, investigated and treated.

Oral Contraceptive Pill

It is, of course, possible to successfully treat many of these menstrual disorders by use of the oral contraceptive pill. The pill is cleared for flight despite its potential side effects such as hypertension and deep venous thrombosis. In the ADF and many other air forces, these risks are considered acceptable, however, a ground trial of one month is required to eliminate the possibility of other systemic effects.

Pregnancy

Pregnancy is of course not an illness but a natural phenomenon. However, it does represent a change to the body's physiology and, as far as female aircrew are concerned, it should be considered as a medical condition with respect to fitness to fly. Areas of concern include flying safety (risks of sudden incapacitation, safety equipment and ergonomic issues), risks to operational effectiveness (psychological and physical distraction), and occupational health and safety issues (stresses on the foetus). The risks associated with these various considerations vary depending on the stage of the pregnancy and particularly trimester by trimester.

First Trimester

The risks of sudden incapacitation are especially high during the first trimester due to complications such as spontaneous abortion, ectopic pregnancy, and morning sickness. Also of concern are the potential effects on the embryo in its most delicate stage of development. Some of these aviation stressors are discussed below.

- **Hypoxia.** Severe hypoxia in certain periods of development has been shown to produce foetal malformations in animals.³⁷ Most aircrew will only be exposed to mild hypoxia under normal flying circumstance and there appears to be no evidence to suggest concern at these levels of hypoxia.³⁸

- **Vibration.** Once again, animal studies have demonstrated the sensitivity of the embryo to this type of stress, with an increase mortality rate in chick embryos and intrauterine growth retardation in mouse embryos.^{39,40} These effects are more evident at certain frequencies.
- **Decompression Illness.** Bubbles formed in decompression illness have the potential to cause more effects in the foetus because of a patent foramen ovale. In addition, there is a hypothetical increased risk in mothers due to increased fat stores and blood flow. Animal studies have also demonstrated that untreated DCI in the mother is likely to produce teratogenic effects in the foetus, but that the incidence of these problems was reduced with hyperbaric treatment.^{41,42} Studies in female divers have reported low birth weight babies and an increased incidence of birth defects.^{43,44} The significance of this for aviators is unknown however due to this theoretical increased risk pregnant females are not permitted to undertake hypobaric chamber training.
- **"G" Effects.** The effects of accelerative forces on the foetus have not been established despite theoretical concerns expressed of a bungy jumping foetus! Physiologically one would predict effects on placental blood flow and placental integrity may be of concern here.
- **Other Aviation Toxins.** The aviation environment contains many potential toxins some of which have the potential to cause effects on the foetus. The effects of exposure to cosmic radiation have been examined at some length in the literature. Concerns include the risk of foetal malformations and possible increased risk of neoplasms in childhood.²⁹

Most studies looking at overall risks to the foetus in this trimester have been performed in female flight attendants. There does not appear to be a significant risk to pregnancies in this group of individuals when all factors are controlled,⁴⁵ however this type of flying environment is vastly different from that of high-performance aircraft.

Of greatest concern for medical practitioners are the medico-legal aspects if complications occur during or after a flight. For all of these reasons, most military forces ground pregnant aviators during the first trimester.

Second Trimester

Maternal complications likely to cause incapacitation are less common in this trimester, however other effects of the pregnancy may become significant, including anaemia and fatigue. Ergonomic issues begin to become an issue during this period including fit of the G-suit and other safety equipment. However, it is a relatively safe time for the foetus. Overall the risks are minimal and as such flying, at least in a multi-crew role, could be permitted on a case by case basis. Flying in high-performance aircraft would still be of some concern.

Third Trimester

Risks to both mother and foetus increase again in this trimester. Specific risks include preeclampsia, premature labour and abruption placentae, and ergonomic problems are exacerbated. In addition, psychological distraction is known to be a problem as the pregnancy progresses. It is therefore common practice to ground aircrew from the start of the third trimester until after the birth.

In summary ADF policy is that all female aircrew, including those flying fast jets, will be grounded as soon as the pregnancy is diagnosed until after the birth of the child. This in itself may be a problem for the military as considerable time and money has been invested to train such aircrew only to have them become unfit to fly for a prolonged period. However, all aircrew are required to perform ground jobs at some stage of their career and therefore female aircrew should be able to manage their family along with career demands.

Cultural Issues

"You would not want to fly a combat mission with a woman"
Ex USAF Chief of Staff, 1992

Squadron Bonding

The issue of squadron bonding appears to be the major concern touted by the leaders of the RAAF fast jet squadrons of today. Squadron morale, and therefore theoretically it's fighting ability, is dependent upon the extremely strong bonding which occurs between squadron members. This is also the case for ground troops. Many

men consider that the presence of women within this environment will upset this delicate balance by introducing the issue of sex, and that the essential bonding fabric will be rent asunder. However, evidence from overseas does not appear to support this. A survey conducted amongst USAF pilots revealed that 97% of males and 98% of females felt comfortable flying in combat with both genders. In addition, 77% of males and 74% of females believed that squadron mission effectiveness had not been changed by mixed-gender flights.⁴⁶

Protective instincts

Another concern raised by male fast jet aircrew is that of the protective instincts of males in both combat and prisoner of war situations. This appears to be a problem even if females elect to take the risk to place themselves in such dangerous situations. In the above study 73% of males reported that they would be more protective of one gender in combat (compared with 6% of females).⁴⁶

Public perceptions

One of the major concerns expressed by governments when deliberating on the women in combat issue was fear of the public's reaction to women returning home from war in body bags. It would appear from recent experience such as during the Gulf War that this is no longer an issue.

Trail blazers

At present only small numbers of female aircrew are being trained by the RAAF. This means that many of these women are still "blazing the trail" for other females and this in turn often attracts media attention. This not only has the potential to cause jealousy amongst colleagues but also the belief that a double standard or quota may apply to these women. Many male instructors also believe that there is increased pressure to pass these women and that the women have to be treated differently from their male counterparts.

Solutions

There are no easy solutions to many of these issues, especially as most relate to the perceptions of male aircrew. However, many of these problems seemed to have been resolved in overseas militaries by such elements as good leadership, time and the emergence of increasing numbers of female aircrew. This has also become evident in RAAF experience as some flying instructors have noticed that concerns currently evident during introductory fighter training have ceased to be issues during initial flying training.

Perhaps these aspects are best summarised in a quote by Major Deanna Brasseur, one of the first female F-18 pilots in the Canadian Forces. Major Brasseur reports experiencing more difficulties as one of her country's first female air weapons controllers than as a pioneer "fast woman".

"As the first woman on my crew, I experienced the stares, the snide comments, the questioning of my abilities and purpose for wanting to be a member of such a previously male environment... Once I had established my credibility . . . and demonstrated that their crude language and bad jokes did not bother me, I was accepted".⁴⁷

Current Issues in the RAAF

Much research is ongoing in the area of female aircrew in general and in particular those flying high-performance aircraft. The RAAF Institute of Aviation Medicine has so far been consulted on the following subjects.

F111 Relief Bags or "Piddle Packs"

In the F111, sorties lasting several hours are possible and a male relief bag with a condom-like attachment is in common use. Unfortunately, this system is not suitable for female use and therefore a variety of other options have been suggested. These range from a simple nappy-like pad to a small collecting device that somehow must be manoeuvred into position in the close and less than private confines of the F111 cockpit.

Saline Breast Implants

A recent enquiry from an ADF Recruiting Centre requested information as to a young woman's fitness to train as aircrew after having undergone a single saline breast implant. This condition is not covered in the ADFP 701 (Recruiting Standards), and little information is available on this subject in the aviation environment. The USAF

does have a policy on this condition for currently serving aircrew, allowing them to return to flying nine months post surgery. This particular potential applicant elected not to apply.

Long Hair

This issue has become a case of Equal Employment Opportunity (EEO) meets flying safety. The problems of long hair are those of adequate helmet fit, risk of entanglement in the ejection seat, and fire risk. A draft Defence Instruction on aircrew dress and grooming implied that all aircrew should have short hair to prevent these problems. This caused some concern amongst our female aircrew and prompted one enterprising female pilot to develop an alternative, a hair bag. This consists of a Nomex cover that can be tucked down into the back of the flying suit thus solving the risks of fire and entanglement. It does not necessarily solve the fitment problems as long hair worn in any style at the back of the head may interfere with nape strap grip. It also poses other problems, particularly the concern that neck movements may be restricted during manoeuvring under high G. A project to assess the virtue of such a bag has been put on hold at present as a further draft Instruction avoids comment on hair length, preferring to emphasise the necessity of an adequate fit.

Conclusions

There is no doubt that women are different in many ways to men. Many of the physiological differences probably require more research to determine their significance, particularly the problems facing older women. The problems relating to physical differences between the sexes can be solved by re-engineering both aircraft and safety equipment to accommodate a greater percentage of the population. Most of the specific women's health issues really should be considered on a case by case basis and treated like any other fitness to fly issue.

This was confirmed by the findings of the United States Commission on the Assignment of Women in the Armed Forces (1992) which stated that there were no physical or physiological reasons why women could not fly combat aircraft.⁴⁸ It has also been proved by the experience of many other nations.

The main reason why the issue surrounding female fast jet aircrew are still of concern in Australia is the novelty aspect - we are dealing with small numbers and the very male fast jet world doesn't know quite what to do with these strange creatures. It is interesting to note that the first two women streamed to fast jets were heading for F111s and not FA-18s. Entry of women into the fighter world will be the final stumbling block but provided she is good enough and strong enough, our first female FA-18 pilot is probably not far away.

A final quote from an article entitled "Females, Girls, and Fighting Marines" from the US Marine Corps Gazette summarises the major problems confronting our prospective female fighter pilots.

"It is not the psychological fortitude of women marines that concerns me but the men they might be serving with."⁴⁹

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