


# Image Cover Sheet

<b>CLASSIFICATION</b>  UNCLASSIFIED	<b>SYSTEM NUMBER</b> 70976 
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**TITLE**  
FEMALE AIRCREW - THE CANADIAN FORCES EXPERIENCE

**System Number:**

**Patron Number:**

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## FEMALE AIRCREW - THE CANADIAN FORCES EXPERIENCE

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## SUMMARY

//Data collected since females first started aircrew training in Canada in 1979 is reviewed. Females are less successful than males in selective competition for training, but once into the training scheme there is no significant sex difference in achieving WINGS standard. Although numbers are still relatively small, female aircrew are now participating equally with their male peers in all aspects of military flying including tactical fighter operations. //

## HISTORICAL PERSPECTIVE

Once upon a time, only men could become operational pilots in the Canadian Forces (CF). In fact, only a limited number of military occupations were open to women, and this policy was based more on tradition and social practice than any scientific basis as to whether either sex could best do the job. Evolving demographic patterns and the changing roles for women ongoing within most societies have caused military planners to consider an expanded occupational potential for women in the military. In Canada, such considerations were intensified during the 1970s largely as a result of Federal Government policies directed to providing equality for men and women in the workplace culminating in the promulgation of the Canadian Human Rights Act in 1977. The Act prohibits sexual discrimination in the employment of an individual unless the employer can establish that the discriminatory practice is based on a bona fide occupational requirement.

The CF response was to establish a trial the purpose of which was to determine the effect of employing Servicewomen in Non-traditional Environments and Roles (SWINTER), but short of full combat duties. The purpose of the Aircrew part of the Trial was to assess the impact on operational effectiveness of employing servicewomen in five previously all-male non-combat squadrons in transport, search and rescue and in training. The trial concluded in October 1985. Recruiting was temporarily suspended between 1984-86 while trial results were being analysed, but active recruiting of female aircrew applicants recommenced late in 1986 and has continued to the present.

The Surgeon General was required to determine what the medical selection standards for female aircrew applicants should be prior to commencement of the trial. Participants for the trial were to be selected forthwith, so a rather hastily called meeting attempted to address the question. A major concern was female upper body strength to do the job, particularly in an emergency situation with loss of operative aircraft systems. A decision was made that the minimum acceptable body weight for females would be some 12% greater than the smallest acceptable male which would equate to at least equal lean body mass with some correlation to similar strength. It was well understood that any standard would likely be challenged under the Human Rights Legislation and such a minimum weight requirement had some scientific validity and was reasonable considering the time constraint. All other standards would be the same as for males.

Candidates for the SWINTER trial were to be selected from the current servicewoman population i.e. from women already serving in other military occupations. The Aircrew Trial specified that 28 women (i.e. 20 pilots, 4 navigators and 4 flight engineers) were to be trained and employed in operational postings; that number was expected to represent some 10% of serving aircrew in selected squadrons and allow a meaningful evaluation. It became apparent that the required numbers for pilot/navigator would not be available from the servicewoman pool and the competition was soon opened to civilian applicants as well. It was also found that the supplementary minimum weight standard for females was impractical to apply and the medical selection standards for females became the same as for males.

## CURRENT CF AIRCREW SELECTION PROCEDURES

The selection of aircrew (pilot and navigator) applicants begins at the local recruiting centre which includes a medical examination. Applicants who satisfy the initial criteria proceed to the second stage of selection at the CF Aircrew Selection Centre (CFASC) and the Central Medical Board (CMB) in Toronto. Assessment here includes a cognitive test battery, a psychomotor test, and an aircrew medical. Results are forwarded to National Defence Headquarters for the third phase where the Directorate of Recruiting and Selection (DRS) considers all information, makes their selection decisions, and authorizes enrolment.

The testing done at CFASC is comprised of the tests listed in table 1. Previous and current research has demonstrated that indices based on the test results are predictive of success in aircrew training.<sup>8</sup> The Visual General Aviation Tester (VGAT) measures the applicant's ability to coordinate body movement to manoeuvre the trainer in specific patterns using aircraft-type controls singly and in combination.

Table 1. ASC Tests Used to Form Predictive Indices

<u>Test Title</u>
*Numerical Ability
Verbal Aptitude
*Arithmetic Aptitude
*Technical Reading Comprehension
*Mathematical Reasoning
*Instrument Reading
Table Reading
Serial Addition
*Visual General Aviation Tester

\*Males score significantly higher in these tests.

The aircrew medical at CMB is designed to meet the exacting CF recruiting policy of universal assignability, that is, that successful applicants must be medically fit to fly all aircraft in the CF inventory. Table 2 lists the assessment procedures.

Table 2. CMB Medical Assessment

1. review of data collected at Stage 1, which includes:
  - a. physical examination,
  - b. ophthalmology,
  - c. audiometry,
  - d. chest x-ray,
  - e. electrocardiogram,
  - f. laboratory results - blood type, serology, hemoglobin, white cell count, fasting blood sugar and cholesterol, urinalysis with microscopic.
2. repeat of any test not done or outside normal limits,
3. anthropometry with measures of standing height, seated height, thigh length and leg length,
4. pulmonary function studies,
5. electroencephalography,
6. echocardiography (since 1985), and
7. review of health history questionnaire and physical examination by the flight surgeon.

#### METHODS

Data collected concerning sex differences in CFASC test results has been summarized. The medical records of female applicants have been reviewed for the period 1979-1988 to determine if there has been any sex difference in medical suitability for aircrew training. Training statistics were then evaluated, again to see if there has been any sex difference in training success rates. Finally, a search was completed to determine the current population of successful female aviators and where they are employed in the CF.

#### RESULTS AND DISCUSSION

##### Aircrew Selection - CFASC Testing

Candidates perform the tests listed in Table 1. These tests are numerically weighted depending on their predictive value insofar as probability of success in pilot or navigator training is concerned. Pilot and Navigator Aptitude Indexes are calculated based on the candidates' scores. The Aptitude Indexes range from 1 to 9; the higher the Index, the greater the probability of success in training. Applicants with Aptitude Indexes of 5 or less are not typically selected.

Table 3. Percentages of Male and Female Applicants at Each Pilot Aptitude Index 1979-1982.

	Pilot Aptitude Index									
	1	2	3	4	5	6	7	8	9	Mean
Females (N=167)	11	6	15	18	15	16	9	7	1	4.45
Males (N=2451)	3	6	9	14	20	17	17	10	5	5.4

Surveys were conducted of candidate performance at the CFASC during the SWINTER trial period; results are listed in Table 3.<sup>4</sup> It demonstrates that only 33% of females while 49% of males achieved indexes of 6 or better. More recent CFASC results at Table 4 demonstrate that females have not closed the gap in their success rate with their male counterparts, and there continues to be a significant difference between the two groups.

Table 4. Male and Female Applicants Achieving a Pilot Aptitude Index of 6 or better.

	Female		Male	
	N	Successful	N	Successful
1987	132	24 (18.2%)	886	327 (36.9%)
1988	136	32 (23.5%)	984	422 (42.9%)
1989	111	20 (18.0%)	1035	465 (44.9%)

It has been evident that females are superior only in verbal ability and clerical speed and accuracy; males are superior in mechanical reasoning, visual spatial ability and quantitative ability.<sup>8</sup> Generally speaking, twice as many male candidates as female can be expected to achieve a successful Pilot Aptitude Index. There has been no sex difference on the Navigator Aptitude Index.

#### Aircrew Selection - Medical Assessment

The medical files of 477 female aircrew applicants were reviewed for the period 1977-1988. 149 of the 477 applicants did not meet the medical standard for pilot selection, a medical rejection rate of 31.2%; the reasons for medical rejection are summarized in Table 5.

Table 5. Reasons for Medical Rejection of 149 out of 477 Female Candidates 1979-1988

Reason	Total Candidates (N=477)	Percentage of Rejected Candidates (N=149)
Anthropometry	61	40.9
Vision	55	36.9
Neurology	16	10.7
Cardiac	12	8.1
Orthopedic	3	2.0
Hearing	1	0.7
Respiratory	1	0.7
Total	149	100

A previous review of all candidate documents for the ten year period 1978-1987 demonstrated an overall medical rejection rate of only 20.3% with 7743 males and 346 females in the survey.<sup>7</sup> A comparison of the reasons for medical rejection in this predominantly male group at Column 1 of Table 6 demonstrates that the only significant difference with the female group is in anthropometry, and it is the major reason for medical rejection in females.

Table 6. Comparison of Reasons for Medical Rejection in Male and Female Candidates.

Reason	Percentage of Total Candidates (N=8039)	Percentage of Female Candidates (N=477)
Anthropometry	2.5	12.8
Vision	11.6	11.5
Neurology	1.5	3.4
Cardiac	2.2	2.5
Orthopedic	0.1	0.6
Hearing	0.3	0.2
Respiratory	0.9	0.2
Other	1.2	
Total	20.3 %	31.2 %

Table 7 shows the current CF anthropometric standards. These standards are based on a survey of serving aircrew, 314 pilots and 290 navigators, published in 1966.<sup>5</sup> The first and 99th percentiles were taken as minima and maxima respectively, and present research would indicate that they may be too lenient for some of our current aircraft. To date, we have been able to insist on these standards although there are two cases of civilian pilots, who were turned down, before our Human Rights Commission awaiting a ruling. Their particular leg lengths were 98.3 and 97.4 cm.

Table 7. CF Anthropometric Standards for Pilot

	Min (cm)	Max (cm)
Standing Height	157	194
Seated Height	86.4	100.3
Thigh Length	54.6	67.3
Leg Length	99.6*	123.2

\*Note - The minimum leg length standard was changed in 1982 from 101.6 to 99.6cm.

There is a third candidate who did not meet the standard but did manage to enter the pilot training program through an administrative waiver. Her measurements were satisfactory except for leg length of 95.0 cm. She was removed from pilot training approximately eight trips short of achieving her wings. The unit flight surgeon, after reviewing her training file, considered it unlikely that anthropometry was a factor, but that the failure was more likely related to personality and an inability to consistently react well in high stress situations. Notwithstanding this opinion, it is generally accepted that our fixed-wing training aircraft, the CT 114 Tutor, has one of our more accommodating cockpits. It is also documented that she had to fly with the seat low to ensure adequate rudder control resulting in a very low seated height and she did experience significant problems in the formation phase of training.

Table 8 illustrates the overall CFASC/CMB experience from 1979-1989. To have been SUCCESSFUL to proceed on pilot training, the candidate had to achieve both an acceptable pilot aptitude index at CFASC and to have met the medical standard for pilot in the CF.

Table 8. CFASC/CMB Testing 1979-1989

	Females (N=604)	Males (N=2905)
SUCCESSFUL - Pilot	118	1043
SUCCESSFUL - Nav	79	411
UNSUCCESSFUL	407	1451
Pilot Success Rate -	19.5%	35.9%

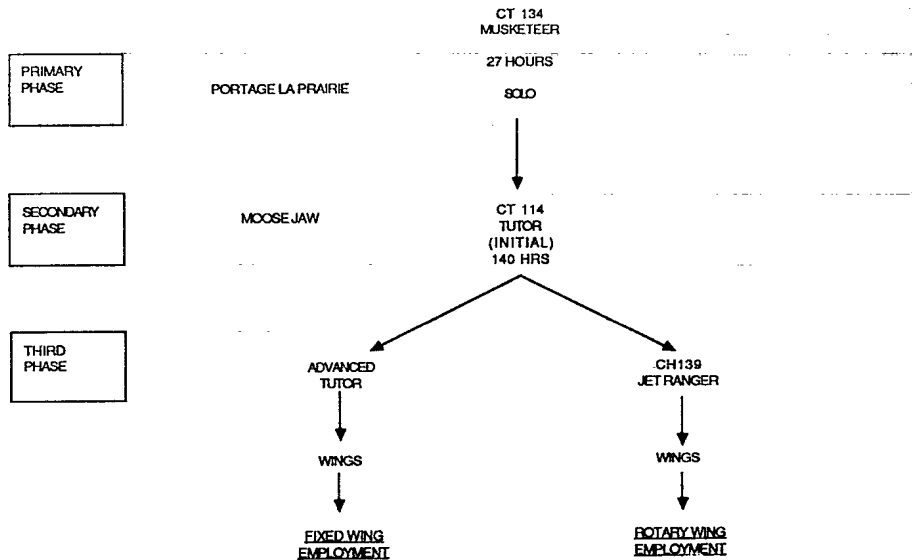
\*The male totals are for the years 1987-1989. The female success rate for those 3 years only is 16.4% (N=379)

The data presented is based on anglophone candidates; female francophone candidates have not done as well. There has been no significant sex difference in the success rate for navigator.

**Training**

In November 1979, the first four female pilot trainees began 15 months of pilot training as depicted in figure 1.

Figure 1. CF Pilot Training Scheme



Primary flying training is conducted at Canadian Forces Base (CFB) Portage La Prairie, Manitoba on the CT 134 Musketeer, a low-wing monoplane piston aircraft manufactured by the Beech Aircraft Corporation. Successful students then proceed to CFB Moose Jaw in Saskatchewan where all students do initial training on the CT 114 Tutor, a completely aerobatic turbo-jet aircraft. Those proceeding to fixed-wing employment complete their training reaching WINGS standard on the Tutor. Students selected for rotary-wing employment break-off and return to CFB Portage La Prairie for basic rotary-wing training reaching WINGS standard on the CH 139 Jet Ranger, a light helicopter. During the trial period, it was the opinion of a significant number of males that selection and training standards were lowered for women, but there is no real evidence for this. In a review of aptitude scores achieved by successful candidates at CFASC 1979-1981, it was determined that 20 of 494 male trainees (4.1%) and 4 of 74 female trainees (5.4%) had had a lower than desirable pilot aptitude index.<sup>4</sup> Given the small number of female trainees, it is considered that the same CFASC standards were used. As with males, the success rate in training does vary from course to course and some individuals take longer to reach wings standard than others. Table 9 summarizes a review of statistics compiled since 1979 and, although the female numbers are few as compared with males, one cannot make any claim for a significant sex difference in success rate.

Table 9. Success Rate of Females Versus Males in Aircrew Training 1980 - 1988

COURSE	Females		Males	
	N	Successful	N	Successful
Pilot Primary Basic Flying Training CT 134	56	39 (70%)	2677	1798 (67%)
Pilot Basic Flying Training CT 114	25	20 (80%)	1568	1257 (80%)
Pilot Advanced Flying Training CT 114	5	4 (80%)	448	431 (96%)
Pilot Rotary Wing Basic	12	11 (92%)	817	801 (98%)
Navigator Basic	13	9 (69%)	446	371 (80%)

Note. 6 females achieved Flight Engineer Status

The flight surgeon at Moose Jaw, who is also a pilot, has noted that most females have gone the Rotary Wing route in training rather than the Advanced Tutor course over the past 3-4 years. His observation is that they tend to be more methodical but generally less aggressive in their approach to flying and it could be postulated that females generally have somewhat less ability or lower motivation for high performance jet flying. It is an observation deserving of further study.

#### Current Employment

As of September 1989, there were 19 qualified female pilots in the Canadian Forces serving with their male counterparts in all areas of the Air Force. Table 10 lists their employment situations at that time. There are also some 56 females presently in training.

Table 10. Employment of Female Aircrew

	Pilots	Navs	Flt Eng
Tactical Fighter Squadron - CF 118	2		
Transport Squadron CC 130 & Challenger	4		3
Tactical Helicopter Squadron	1		
Light Transport - Search and Rescue (RW)	4		1
Flying Training	3		
Maritime Patrol Squadron		1	
Staff Positions	5	5	

Males usually shun staff positions for as long as possible. An interesting comment by a female personnel research officer was that married female pilots are quite receptive to staff positions earlier in their career as it does allow them time to complete other aspects of their life planning 'Check List' such as becoming pregnant.

#### CONCLUSIONS

Much larger numbers of males than females continue to apply for aircrew training in Canada. Selection test data over a 10 year period indicate that females score significantly lower in quantitative and spatial/psychomotor skills; as long as the Pilot job task emphasizes these skills, proportionately fewer females will be selected for training. Medical assessment data does indicate that a greater number of females will fail to meet the medical standard for pilot. The only reason for the difference is in the area of anthropometry. Again, as long as military cockpits are designed primarily with male indices, a greater number of females will continue to be excluded. Experience over the period has demonstrated that appropriately selected female aircrew, that is, using the same standards as for males, can perform equally with their male peers during training and in operational flying in the Air Force.

#### ACKNOWLEDGEMENTS AND REFERENCES

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