Cockpit accommodation of the CH139 Jet Ranger training helicopter

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Abstract

An anthropometric assessment of the CH139 Jet Ranger helicopter was performed to determine the limits of accommodation of the cockpit. Ten subjects were recruited from the pool of students and instructors located at 3 Canadian Forces Flying Training School (CFFTS) in Southport, Manitoba. Each subject underwent a series of test sessions according to seat position (left and right), seat type (normal and low profile), and clothing conditions (summer and winter). The performance elements that were assessed in the cockpit were hand and foot reaches, visibility of flight instruments, cyclic stick authority, and helmet clearance. Since the Jet Ranger cockpit is relatively small, reach to pedals and controls as well as visibility were adequate for all test subjects. On the other hand, larger subjects tend to experience clearance problems, particularly between the helmet and the centre overhead console. Results of the assessment indicate that the low profile seat provides a significant increase in maximum sitting height compared to the regular seat, although the estimated maximum sitting heights are still somewhat below the maximum allowed by the Canadian Forces selection criteria. It is expected that a small percentage of the population, of the order of two to four percent, would be too large for this aircraft with the low profile seat.

Résumé

Une évaluation anthropométrique de l’hélicoptère CH139 Jet Ranger a été effectuée afin de déterminer les limites d’habitabilité du poste de pilotage. Dix sujets ont été recrutés au sein d’un bassin constitué des élèves et des instructeurs de la 3e École de pilotage des Forces canadiennes (3 EPFC) de Southport (Manitoba). Chaque sujet a subi une série d’essais aux différents postes (gauche et droit), sur les différents sièges (normal et bas) et avec les différentes tenues (été et hiver). Les critères d’évaluation du poste de pilotage ont été la portée des mains et des pieds, la visibilité des instruments de vol, le contrôle du manche de pas cyclique et le dégagement au-dessus du casque. Étant donné la petite taille du poste de pilotage du Jet Ranger, la distance des pédales et des commandes, de même que la visibilité, ont été adéquates pour l’ensemble des sujets soumis aux essais. Les sujets plus grands, par contre, ont tendance à avoir des problèmes de dégagement, tout particulièrement entre leur casque et la console centrale du plafond. Les résultats de l’évaluation indiquent que les sièges bas permettent, par rapport aux sièges normaux, un accroissement significatif de la taille maximale assise, mais les tailles maximales assises prévues demeurent néanmoins légèrement inférieures au maximum permis par les critères de sélection des Forces canadiennes. Il est escompté qu’une faible proportion de la population, de l’ordre de deux à quatre pour cent, soit trop grande pour pouvoir s’asseoir dans cet appareil sur un siège bas.

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Executive summary

The DND is in the process of addressing its future helicopter flying training needs and is investigating various options to deliver its training programme. One of the aims of the Contracted Flying Training Support (CFTS) project is to “address known deficiencies in each of the (training) phases” (CFTS, 2001), including pilot accommodation or “cockpit size” issues.

The Jet Ranger (BH06) is included in one of the options to provide this training, but helmet clearance has been an issue in the past, hence the recent addition of a low profile seat configuration. Since the issue of anthropometric accommodation of the Jet Ranger is not well documented, DRDC-Toronto was tasked by the CFTS project to determine the limits of accommodation of this cockpit.

Ten subjects were recruited from the pool of students and instructors located at 3 Canadian Forces Flying Training School (CFFTS) in Southport, Manitoba. Each subject underwent a series of test sessions according to seat position (left and right), seat type (normal and low profile), and clothing conditions (summer and winter). The performance elements that were assessed in the cockpit were hand and foot reaches, visibility of flight instruments, cyclic stick authority, and helmet clearance. Since the Jet Ranger cockpit is relatively small, reach to pedals and controls as well as visibility were adequate for all test subjects, but larger subjects tended to experience clearance problems, particularly between the helmet and the centre overhead console.

The results of the assessment indicated that the low profile seat provided a significant increase in maximum sitting height compared to the regular seat. However, the estimated maximum sitting heights are still somewhat below the maximum allowed by the Canadian Forces selection criteria, which means that a small percentage of the pilot population (two to four percent) is expected to be too large for this aircraft.

Meunier, P, 2002. Cockpit accommodation of the CH139 Jet Ranger training helicopter. DRDC Toronto TR 2003-005. Defence R&D Canada – Toronto.

Sommaire

Le MDN est actuellement en train de se pencher sur ses futurs besoins de formation au pilotage sur hélicoptère et envisage diverses façons d'assurer ce programme de formation. L'un des objectifs du projet de Forfait d'entraînement au vol et de soutien (FEVS) est de « remédier aux lacunes connues de chacune des phases (de la formation) » (FEVS, 2001), y compris aux problèmes d'habitabilité, ou de « taille », du poste de pilotage auxquels peuvent être confrontés les pilotes.

Le Jet Ranger (BH06) constitue l'une des options envisagées pour offrir la formation, mais le dégagement au-dessus du casque a déjà causé des problèmes dans le passé, d'où la récente addition d'une configuration comportant des sièges plus bas. Étant donné que les caractéristiques anthropométriques de l'habitabilité du Jet Ranger sont mal connues, le RDDC-Toronto s'est vu chargé, dans le cadre du projet FEVS, d'établir les limites d'habitabilité de ce poste de pilotage.

Dix sujets ont été recrutés au sein d'un bassin constitué des élèves et des instructeurs de la 3e École de pilotage des Forces canadiennes (3 EPFC) de Southport (Manitoba). Chaque sujet a subi une série d'essais aux différents postes (gauche et droit), sur les différents sièges (normal et bas) et avec les différentes tenues (été et hiver). Les critères d'évaluation du poste de pilotage ont été la portée des mains et des pieds, la visibilité des instruments de vol, le contrôle du manche de pas cyclique et le dégagement au-dessus du casque. Étant donné la petite taille du poste de pilotage du Jet Ranger, la distance des pédales et des commandes, de même que la visibilité, ont été adéquates pour l'ensemble des sujets soumis aux essais, mais les sujets plus grands ont eu tendance à avoir des problèmes de dégagement, tout particulièrement entre leur casque et la console centrale du plafond.

Les résultats de l'évaluation indiquent que les sièges bas permettent, par rapport aux sièges normaux, un accroissement significatif de la taille maximale assise. Mais les tailles maximales assises prévues demeurent néanmoins légèrement inférieures au maximum permis par les critères de sélection des Forces canadiennes et il est escompté qu'une faible proportion de la population, de l'ordre de deux à quatre pour cent, soit trop grande pour pouvoir s'asseoir dans cet appareil sur un siège bas.

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1. Introduction

The DND is in the process of addressing its future helicopter flying training needs and is investigating various options to deliver its training programme. One of the aims of the Contracted Flying Training Support (CFTS) project is to "address known deficiencies in each of the (training) phases" (CFTS, 2001), including pilot accommodation or "cockpit size" issues.

The Jet Ranger (BH06) is included in one of the options to provide this training, but helmet clearance has been an issue in the past, hence the recent addition of a low profile seat configuration. Since the issue of anthropometric accommodation of the Jet Ranger is not well documented, DRDC-Toronto was tasked by the CFTS project in August 2002 to determine the limits of accommodation of this cockpit. The study, which was coordinated with the Canadian Forces Flying Training School (CFFTS) in Southport, Manitoba, took place on the week of September 23rd 2002.

2. Method

2.1 Subjects

Ten subjects were recruited from the pool of students and instructors located at 3 Canadian Forces Flying Training School (CFFTS). The anthropometric characteristics of the personnel were obtained from the database of their measurements taken during the recruitment process at the Central Medical Board (CMB) in DRDC-Toronto. Stature and weight, which are general indicators of lengths and circumferences, were used as the subject selection variables. Figure 1 shows that the subjects covered a reasonable range of statures, but were on the light side of the weight distribution compared to the general pilot population as characterized by the 1985 survey of aircrew (Stewart, 1985). It should be pointed out that although the 1985 survey contains pilot and navigator data, only pilot data were used in the graphs below.

Figure 2 compares the test subject pool to the 1985 survey of pilots in terms of their proportion of torso length to leg length. Again, the plot shows a reasonable distribution of sitting heights, which was of primary importance, and a somewhat centralized leg length distribution devoid of extremes.

2.2 Test protocol

The test protocol for the Jet Ranger was established with the help of Captain Peter Harrison of 3 CFFTS. The usual flight-essential accommodation criteria were discussed, including: external and internal visibility requirements, reach to pedals and controls, and clearances. A short list of items was identified that assessed the essential elements of this cockpit, i.e. reach to the yaw pedals, visibility of flight instruments that might be occluded by the glareshield, reach of some of the controls, cyclic stick authority, and helmet clearance. The data collection sheet is provided as Annex A.

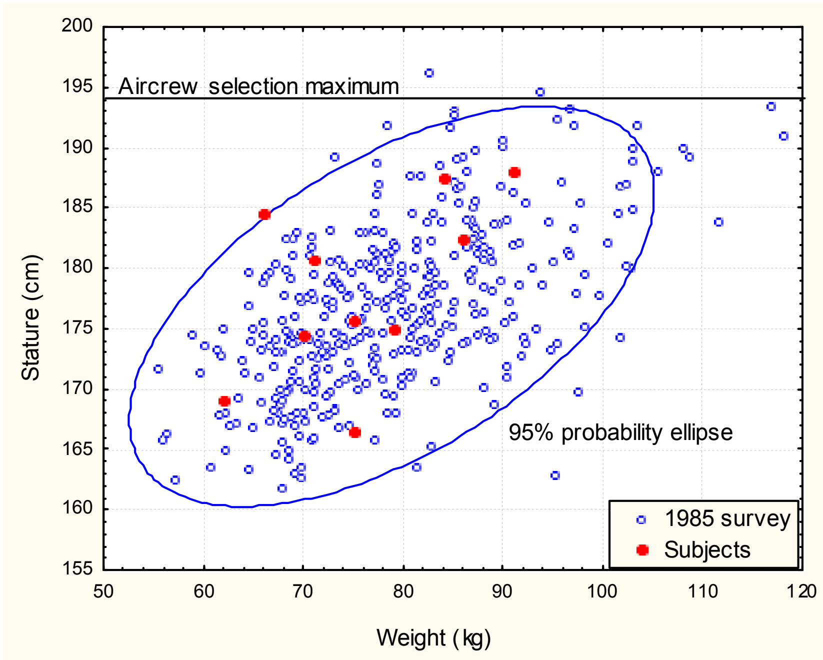

Figure 1. *Stature vs. weight of test subjects relative to 1985 survey of pilots.*

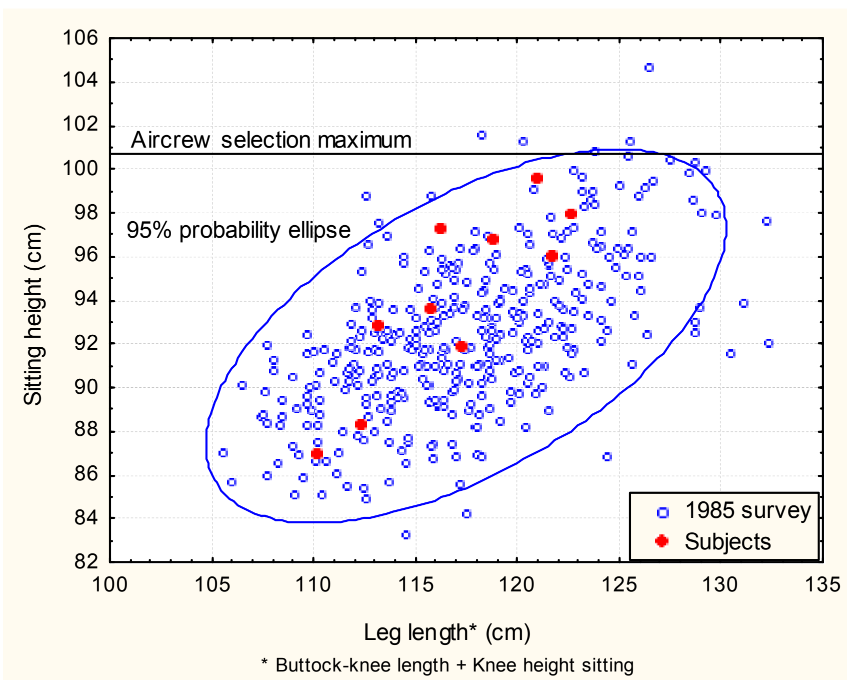

Figure 2. *Sitting height vs. leg length of the test subjects, relative to 1985 survey of pilots.*

Anthropometric measurements were taken of each subject upon arrival to the hangar. The measurements included (see Annex B for details and definitions):

- Weight
- Stature
- Sitting height
- Top of helmet height
- Eye height sitting
- Acromial height sitting
- Knee height sitting
- Buttock-knee length
- Hip breadth sitting
- Biacromial breadth
- Bideltoid breadth
- Functional reach
- Thigh circumference
- Span
- Waist depth

Since helmet clearance was of primary interest, an additional measurement was made to the top of the helmet to account for the fit of the helmet. This extra measurement is similar to Sitting Height, but with the subject wearing a helmet.

After being measured, the subjects dressed in summer flying clothing and took place in the left seat, which had a regular seat. After strapping in, the subjects were asked to adjust the pedals to a comfortable position. The pedal adjustment position was recorded. The subjects were then asked whether they had full view of the instruments located immediately below the glareshield (attitude indicator, altimeter and torque meter) and to reach the Engine Out Warning, and the Communication Control panel. They were then asked to move the cyclic neutral left and right with the collective at about 80% power. Any interference with the legs was noted, and stick range of motion limitations measured. Lastly, clearance between the helmet and the overhead console was measured using a stack of 4-mm thick spacers.

The subjects were asked to switch to the low-profile seat, shown in Figure 3 with the removable cushion. The pedals were adjusted as required and a visibility assessment was made of the same flight instruments. Reaches to the TOT and fuel switches, as well as the

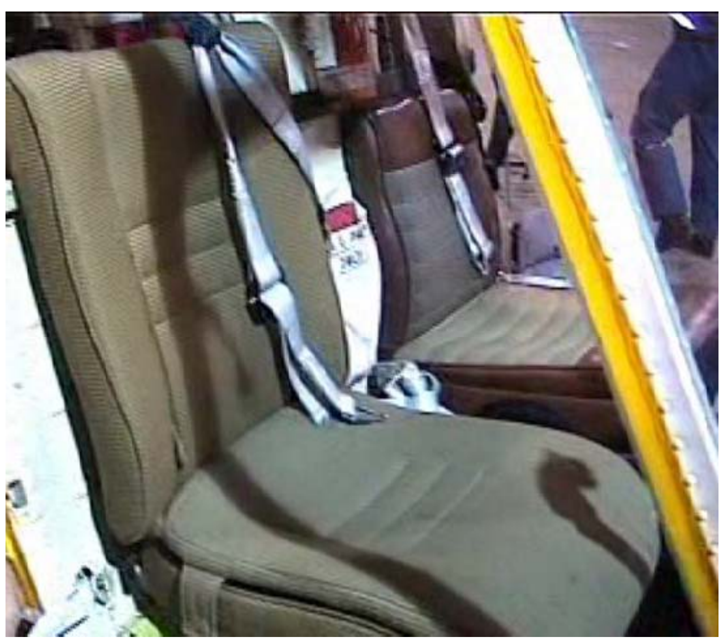

Figure 3. *Low-profile seat (foreground) and regular seat (background).*

Communication Control panel were assessed.

The neutral left and right cyclic range of motion was assessed as before, as was helmet clearance. The cushion was then removed, and a second helmet clearance measurement was made.

3. Results and discussion

3.1 Pedal adjustment

Figure 4 shows the pedal position in terms of leg length defined as the addition of thigh length (buttock-knee length) and lower leg length (knee height sitting). Since there was no difference between summer and winter clothing conditions, or between the regular seat and the low profile seat, the four datasets were pooled. The graph shows that pedal adjustment increases with leg length, defined here as buttock-knee length plus knee height sitting, up to about 1140 mm. Beyond that, individuals will adjust the pedals as far forward as possible.

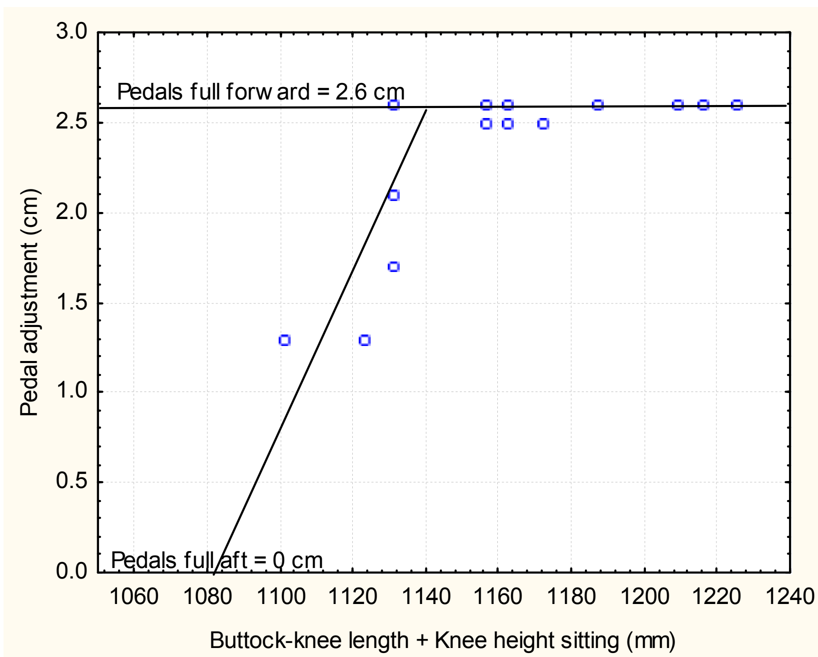

Figure 4. Pedal adjustment vs. leg length.

In terms of population accommodation, this means that about 75% of the CF pilot population[1] will adjust the pedals full forward. It is expected, from the slope of the regression line, that the remaining 25% of the population will find a suitable pedal adjustment even without the addition of an Obus Forme® cushion[2]. Thus, it appears that the range of pedal adjustment is adequate for the range of pilots currently accepted in the CF, and that the accommodation range would be extended through the use of a back rest such as the Obus Forme®.

[1] Based on the 1985 survey of pilots (Stewart, 1985)
[2] It should be noted that Obus Forme® cushions were not examined in this evaluation.

3.2 Reach

All of the subjects tested were able to reach the necessary controls and displays with ease, in summer and winter clothing conditions. Reach was not a limiting factor with respect to accommodation.

3.3 Cyclic range of motion

All subjects were able to obtain full authority of the cyclic in summer and winter clothing, although some of the subjects could only achieve this by pushing the stick firmly against their leg.

3.4 Helmet clearance

The similarity of results between the left and right regular seats confirms the symmetry of the cockpit with respect to helmet clearance, making left and right seat results interchangeable. Those data were therefore pooled in the analysis.

The maximum sitting height, which is required to make inferences about the population of CF pilots accommodated by the cockpit, was calculated as follows for each subject:

Max. sitting height = (helmeted seated height + distance between helmet and overhead console)– helmet thickness – 10 mm,

where helmet thickness is an average value calculated as follows:

$$HelmetThickness = \sum_{i=1}^{n}(HelmetedSeatedHeight - SittingHeight) \div n = 35 \pm 8 \text{ mm},$$

where n is the number of subjects.

The final term in the equation is an arbitrary clearance figure of 10 millimetres to allow room for head movement. It should be noted that the variation in “as-worn” helmet thickness of ± 8 mm is comparable to the arbitrary minimum clearance, making helmet fit a non-negligible variable. This suggests that borderline cases could gain through the optimization of helmet fit.

Figure 5 compares the estimated maximum sitting heights for the various seat conditions in summer and winter clothing. The box plot shows the mean (centre point), the standard error of the mean (box), and standard deviation (whiskers) of the maximum sitting heights results as calculated above. The means represent the best estimate of the maximum sitting heights, and were the values used in the following analysis.

From the data, it is apparent that:

1) the low profile seat provides a substantial increase in maximum sitting height over the regular seat;

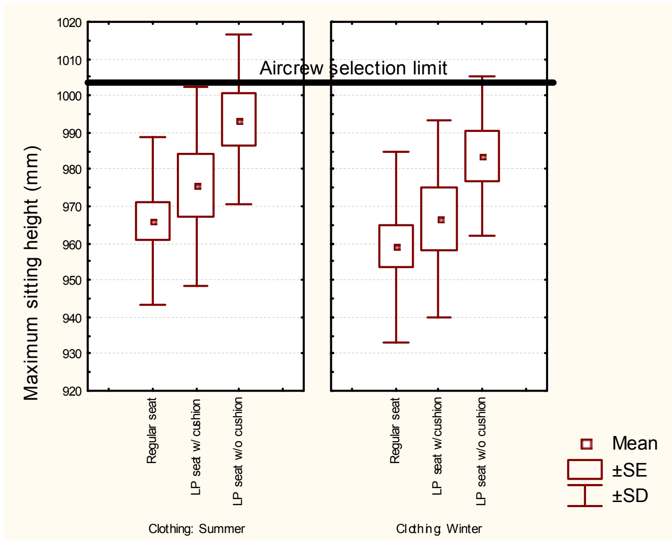

Figure 5. *Estimated maximum sitting heights, summer and winter.*

2) the estimated maximum sitting heights for the low profile seat are still below the aircrew selection criteria and would therefore restrict the user population somewhat;
3) the winter clothing caused a measurable decrease in maximum sitting height (7 to 10 millimetres)

In terms of percentage of the pilot population[3] accommodated, Figure 6 shows that use of the low profile seat generally increases the accommodation rate by about 10% over the regular seat: accommodation goes from 89% to 98% in summer clothing, and 85% to 96% in winter clothing.

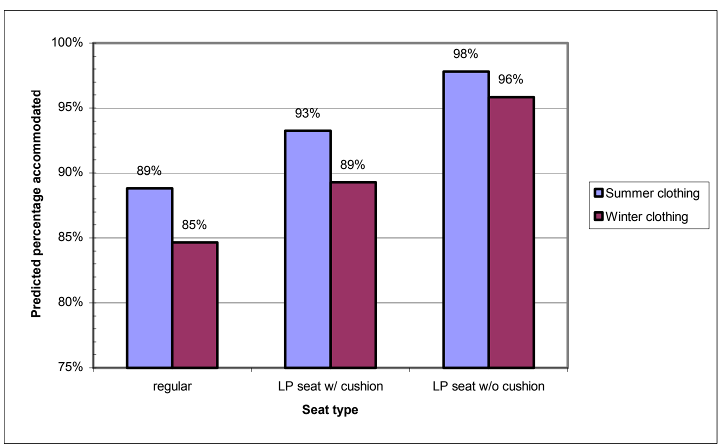

Figure 6. *Predicted percentage accommodation for the three seat configurations in summer and winter clothing.*

It should be noted that although the means of the box plots of Figure 5 provide the best estimate of the maximum sitting height, the variability of the results should not totally be overlooked. The rather large standard deviation of the results (15 to 27 mm) deserves further discussion. Three important sources of variation, although measured, were not used in the

[3] Based on the database of 1985 pilots (Stewart, 1985)

analysis: sitting posture (i.e. fore and aft position of the head relative to the seat), the amount of seat deflection, and helmet fit or added thickness. Head position was captured by measuring the distance from the back of the helmet to the seatback bars; seat deflection was inferred from regression equations, since weight was found to be a significant variable; the helmet fit effect was captured through measurement of sitting height of individuals wearing their helmet. Regression equations were obtained that provided excellent predictions of helmet clearance using those variables, as shown in Figure 7. The regression equation shown has a coefficient of determination R^2 of 0.95, which means that 95% of the variability in the data is explained by these three variables, and predicts helmet clearance, on average, within 5 mm of the actual clearance (vice 15 to 27 mm).

$$Helmet\ clearance = -0.049HsitHt + .026HB - 0.054Wt + 52$$

Where,

HsitHt = helmeted sitting height (mm)
HB = helmet to backrest distance (mm)
Wt = weight (kg)

Although the above regression equation is of no value in predicting accommodation (because it makes use of variables that imply that an accommodation test was carried out) its purpose is to demonstrate the importance of elements other than sitting height in the prediction of accommodation. These elements are: helmet thickness, seat deflection characteristics, and individual sitting posture.

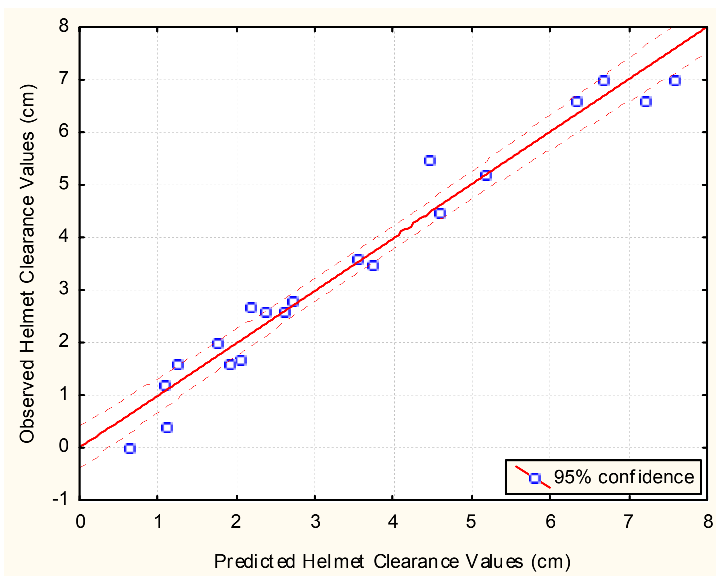

Figure 7. *Predicted vs. Observed helmet clearance for subjects in summer clothing in the regular seat.*

4. Conclusions

The findings of this study can be summarized as follows:

1. Helmet clearance emerged as the only limiting accommodation factor in this evaluation;
2. Internal and external visibility, yaw pedal adjustment, reach, and cyclic range of motion do not appear to cause much, if any, accommodation problem;
3. In terms of accommodation, the newly introduced “low-profile seat” increases the CF pilot accommodation rate from 89% to 98% in summer clothing, and from 85% to 96% in winter clothing;
4. Helmet fit variability, as it relates to the helmeted seated height of individuals, was found to be of sufficiently large magnitude that its optimization should be carefully considered in borderline cases as a means of improving accommodation.

The estimated maximum sitting heights can be summarized as follows:

Table 1 Estimated maximum sitting heights*

	Maximum sitting height (mm)		
Seat Type	Summer	Winter	Difference
Regular	966	959	7
Low-profile, w/o cushion	994	984	10
Difference	28	25	

* Includes 10mm minimum spacing

5. References

CFTS (2001). *Contracted Flying Training and Support (CFTS); Statement of Operational Requirements.* Draft version 10.0, Department of National Defence, Ottawa, Ontario

Chamberland, A., R. Carrier, F. Forest and G. Hachez (1998). *Anthropometric survey of the Land Forces (LF97).* 98-CR-15, Defence and Civil Institute of Environmental Medicine, Toronto, Ontario

Stewart, L. E. (1985). *1985 Anthropometric survey of Canadian forces aircrew.* DCIEM-TR-85-12-01, Defence and Civil Institute of Environmental Medicine, Toronto, Ontario

Annex A Data collection sheet, Jet Ranger

Subject Name ______

		Left Seat (regular seat)	
		Summer	Winter
Rotor Pedals	Adjustment		
Internal vision	Attitude Indicator		
	Altimeter		
	Torque		
Reach	Engine out warning		
	Communication control panel		
Cyclic	Neutral left		
	Neutral right		
Helmet clearance	Centre console (cm)		
	Back of helmet to seat posts (cm)		

		Right seat					
		Summer			Winter		
		Low profile with cushion	Low profile w/o cushion	Regular Seat	Low profile with cushion	Low profile w/o cushion	Regular Seat
Rotor Pedals	Adjustment						
Internal vision	Attitude Indicator						
	Altimeter						
	Torque						
Reach	T.O.T test						
	Fuel switch						
	Communication control panel						
Cyclic	Neutral left						
	Neutral right						
Helmet clearance	Centre console (cm)						
	Back of helmet to seat posts (cm)						

Annex B Anthropometric data

Table 2 *Anthropometric measurements of subjects (mm)*

Subject	1	2	3	4	5	6	7	8	9	10
Weight (kg)	70	75	86	66	71	91	75	84	79	62
Stature	1744	1756	1825	1845	1808	1880	1665	1875	1750	1691
Upper thigh circumference	553	702	692	580	577	658	630	620	594	613
Functional Reach	756	721	786	811	775	818	759	796	772	734
Span	1777	1680	1806	1826	1843	1878	1777	1936	1750	1666
Sitting height	929	937	961	968	973	996	870	980	919	884
Top of helmet height	947	976	1000	1003	1008	1035	911	1013	965	907
Eye height sitting	808	835	837	855	863	886	733	865	793	763
Acromial height sitting	633	590	546	638	647	662	607	605	648	629
Knee height sitting	535	538	566	581	553	568	506	573	546	526
Biacromial breadth	415	370	422	408	405	436	406	420	407	339
Bideltoid breadth	473	459	513	438	483	511	480	493	491	389
Hip breadth sitting	342	395	385	354	364	396	367	372	369	383
Waist depth	203	199	238	206	228	241	214	250	247	193
Buttock-knee length	596	618	650	606	609	641	595	652	626	597

Table 3 *Anthropometric measurements of subjects (percentile)*

Subject	1	2	3	4	5	6	7	8	9	10
Weight (kg)	20	36	75	11	23	87	36	68	50	6
Stature	36	43	80	87	72	95	6	94	39	13
Upper thigh circumference	13	99	99	32	30	92	76	69	45	62
Functional Reach	16	3	41	66	31	72	18	51	28	6
Span	27	3	40	50	58	74	27	92	17	2
Sitting height	56	65	86	90	92	98	6	95	45	13
Eye height sitting	51	79	80	92	95	99	2	95	34	10
Acromial height sitting	83	30	2	87	93	98	52	50	93	79
Knee height sitting	12	14	51	73	31	54	1	61	23	6
Biacromial breadth	76	3	87	62	55	97	57	84	59	<1
Bideltoid breadth	29	12	89	2	46	88	41	64	61	<1
Hip breadth sitting	11	85	73	23	38	86	43	52	47	70
Waist depth	37	32	74	40	64	77	49	84	82	26
Buttock-knee length	32	62	93	45	50	87	31	94	72	33

Definitions

The following are some of measurement definitions used in this study (taken from Chamberland et al., 1998).

Sitting Height (4)

The vertical distance between a sitting surface and the top of the head is measured with an anthropometer. The subject sits erect with the head in the Frankfort plane. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The thighs are parallel and the knees are flexed 90 degrees with the feet in line with the thighs. The measurement is made at the maximum point of quiet respiration.

Eye Height, Sitting (154)
The vertical distance between a sitting surface and the ectocanthus landmark on the outer comer of the right eye is measured with an anthropometer. The subject sits erect with the head in the Frankfort plane. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The thighs are parallel and the knees are flexed 90 degrees with the feet in line with the thighs. The measurement is taken at the maximum point of quiet respiration.

Acromial Height, Sitting (157)
The vertical distance between a sitting surface and the acromion landmark on the tip of the right shoulder is measured with an anthropometer. The subject sits erect looking straight ahead. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The measurement is made at the maximum point of quiet respiration.

Knee Height, Sitting (164)
The vertical distance between a footrest surface and the suprapatella landmark at the top of the right knee (located and drawn while the subject stands) is measured with an anthropometer. The subject sits with the thighs parallel, the knees flexed 90 degrees, and the feet in line with the thighs.

Buttock-Knee Length (169)
The horizontal distance between a buttock plate placed at the most posterior point on either buttock and the anterior point of the right knee is measured with an anthropometer. The subject sits erect. The thighs are parallel and the knees flexed 90 degrees with the feet in line with the thighs.

Functional Leg Length (171)
The straight-line distance between the plane of the bottom of the right foot with the leg extended and the back of the body of a seated subject is measured with an anthropometer passing over the trochanter landmark on the side of the hip. The subject sits erect on a stool 40.8 cm high. The right leg is extended and the foot is on the base plate of the anthropometer, which rests on the floor. The measurement is made from the footrest surface of the base plate.

Span (10)
The distance between the tips of the middle fingers of the horizontally outstretched arms is measured on a wall chart. The subject stands erect with the back against a wall-mounted scale and the heels together. Both arms and hands are stretched horizontally against a back wall with the tip of the middle finger of one hand just touching a sidewall. A block is placed at the tip of the middle finger of the other hand to establish the measurement on the scale. The measurement is taken at the maximum point of quiet respiration.

Thumbtip Reach (189)
The horizontal distance from a back wall to the tip of the right thumb is measured on a wall scale. The subject stands erect in a comer looking straight ahead with the feet together and the heels 20 cm from the back wall. The buttocks and shoulders are against the wall. The right arm and hand, palm down, are stretched forward horizontally along a scale on the sidewall. The thumb continues the horizontal line of the arm and the index finger curves around to touch the pad at the end of the thumb. The subject's right shoulder is held against the rear wall.

Biacromial Breadth (47)
The distance between the right and left acromion landmarks at the tips of the shoulders is measured with a beam caliper. The subject sits erect. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The measurement is taken at the maximum point of quiet respiration.

Bideltoid Breadth (48)
The maximum horizontal distance between the lateral margins of the upper arms on the deltoid muscles is measured with a beam caliper. The subject sits erect looking straight ahead. The shoulders and upper arms are relaxed and the forearms and hands are extended forward horizontally with the palms facing each other. The measurement is made at the maximum point of quiet respiration.

Annex C CF aircrew selection limits

Table 4 Current Canadian Forces pilot selection limits (mm).

	Stature	Sitting height	Buttock-knee length	Functional leg length
Minimum	1570	864	546	996
Maximum	1940	1003	673	1232

List of symbols/abbreviations/acronyms/initialisms

CFTS	Contracted Flying Training Support
CMB	Central Medical Board
DND	Department of National Defence
TOT	Turbine Outlet Temperature (test switch)

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14. ABSTRACT

(U) An anthropometric assessment of the CH139 Jet Ranger helicopter was performed to determine the limits of accommodation of the cockpit. Ten subjects were recruited from the pool of students and instructors located at 3 Canadian Forces Flying Training School (CFFTS) in Southport, Manitoba. Each subject underwent a series of test sessions according to seat position (left and right), seat type (normal and low profile), and clothing conditions (summer and winter). The performance elements that were assessed in the cockpit were hand and foot reaches, visibility of flight instruments, cyclic stick authority, and helmet clearance. Since the Jet Ranger cockpit is relatively small, reach to pedals and controls as well as visibility were adequate for all test subjects. On the other hand, larger subjects tend to experience clearance problems, particularly between the helmet and the centre overhead console. Results of the assessment indicate that the low profile seat provides a significant increase in maximum sitting height compared to the regular seat, although the estimated maximum sitting heights are still somewhat below the maximum allowed by the Canadian Forces selection criteria. It is expected that a small percentage of the population, of the order of two to four percent, would be too large for this aircraft.

(U) Une évaluation anthropométrique de l'hélicoptère CH139 Jet Ranger a été effectuée afin de déterminer les limites d'habitabilité du poste de pilotage. Dix sujets ont été recrutés au sein d'un bassin constitué des élèves et des instructeurs de la 3e École de pilotage des Forces canadiennes (3 EPFC) de Southport (Manitoba). Chaque sujet a subi une série d'essais aux différents postes (gauche et droit), sur les différents sièges (normal et bas) et avec les différentes tenues (été et hiver). Les critères d'évaluation du poste de pilotage ont été la portée des mains et des pieds, la visibilité des instruments de vol, le contrôle du manche de pas cyclique et le dégagement au-dessus du casque. Étant donné la petite taille du poste de pilotage du Jet Ranger, la distance des pédales et des commandes, de même que la visibilité, ont été adéquates pour l'ensemble des sujets soumis aux essais. Les sujets plus grands, par contre, ont tendance à avoir des problèmes de dégagement, tout particulièrement entre leur casque et la console centrale du plafond. Les résultats de l'évaluation indiquent que les sièges bas permettent, par rapport aux sièges normaux, un accroissement significatif de la taille maximale assise, mais les tailles maximales assises prévues demeurent néanmoins légèrement inférieures au maximum permis par les critères de sélection des Forces canadiennes. Il est escompté qu'une faible proportion de la population, de l'ordre de deux à quatre pour cent, soit trop grande pour pouvoir s'asseoir dans cet appareil sur un siège bas.

15. KEYWORDS, DESCRIPTORS or IDENTIFIERS

(U) CFTS; cockpit accommodation; pilot selection; anthropometry; CH139; Jet Ranger