

ACTUARIAL REPORT

31 March 1997

Life Insurance Plan

Canadian Forces

27 February 1998

The Honourable Marcel Massé, P.C., M.P.
President of the Treasury Board
Ottawa, Canada
K1A 0R5

Dear Minister:

Pursuant to section 71 of the *Canadian Forces Superannuation Act* (CFSA), and its reference to the *Public Pensions Reporting Act*, I am pleased to submit my report on the actuarial review as at 31 March 1997 of the life insurance plan established under Part II - *Supplementary Death Benefits* of the CFSA.

Yours sincerely,

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Chief Actuary
Public Insurance and Pension Programs

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I- Overview

The financial soundness of the life insurance plan established for the members of the regular force under Part II - *Supplementary Death Benefits* (SDB) of the *Canadian Forces Superannuation Act* (CFSA) rests on the balance in the Regular Force Death Benefit (RFDB) Account which forms part of the public debt of Canada. The plan is not funded through investment in marketable securities. The plan's assets are in effect borrowed by the government.

A- Raison d'être of this Actuarial Report

This actuarial review of the SDB plan was made as at 31 March 1997 pursuant to section 71 of the CFSA and its reference to the *Public Pensions Reporting Act* (PPRA). The previous review was made as at 31 December 1993. This report is thus the first to be based on fiscal years rather than calendar years. The date of the next periodic review contemplated by the PPRA is 31 March 2000.

In accordance with accepted actuarial practice, and both the CFSA and the PPRA, the main purpose of this report is to present a realistic long-term projection of the assets, liabilities and surplus of the plan at the end of each plan year¹ of the projection period in order to assess the adequacy of the legislative contribution rates.

B- Main Findings

1. As at 31 March 1997, the plan had a surplus of \$113.6 million resulting from assets of \$172.1 million and liabilities of \$58.5 million.
2. The current surplus of \$113.6 million in the RFDB Account is projected to gradually vanish and become a deficit after plan year 2007 because projected benefits exceed for each plan year the sum of legislated contributions and projected investment earnings.
3. For the same reason, the current balance of \$172.1 million in the RFDB Account is projected to become exhausted during plan year 2015.

C- Developments Since the Previous Report's Date

The above estimates are based on key ultimate economic assumptions unchanged from those of the previous report, i.e. a new money interest rate of 6% and an annual rate of increase in salaries of 4%.

No modifications were made to the SDB plan since the previous report's date. The provisions of the plan deemed to apply for purposes of this

¹ Any reference to a given *plan year* in this report should be taken as the 12-month period ending 31 March of the given year.

report are described in Appendix 1 (page 20) and reflect those that were in effect as at the valuation date.

II- Data

A- Assets

1. Reconciliation of Balances in the RFDB Account

(in millions of dollars)				
Account balance as at 31 December 1993				155.2
Net cash flow from 1 January 1994 to 31 March 1994				1.6
Plan year	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1995-97</u>
Public Accounts opening balance	156.8	164.8	168.1	156.8
INCOME				
Participant contributions	10.1	10.0	10.0	30.1
Government contributions	1.7	2.2	2.1	6.0
Single premium for paid-up insurance	0.5	0.6	0.6	1.7
Investment earnings	<u>16.1</u>	<u>16.6</u>	<u>16.7</u>	<u>49.4</u>
Subtotal	28.4	29.4	29.4	87.2
EXPENDITURES				
Benefits	20.4	26.1	25.4	71.9
Public Accounts closing balance	164.8	168.1	172.1	172.1

The above table shows the reconciliation of the RFDB Account from the previous valuation date to the current valuation date. Since the previous report's date, the Account balance has grown by \$16.9 million (i.e. a 10.9% increase) to reach \$172.1 million as at 31 March 1997.

2. Rates of Return

The following rates of return on the Account in each of the last three plan years were calculated, using the foregoing entries, on the assumption that all transactions other than investment earnings occurred at the midpoint of the plan year:

<u>1995</u>	<u>1996</u>	<u>1997</u>
10.53%	10.53%	10.28%

3. Sources of Asset Data

The Account entries shown in item 1 above were taken from the Public Accounts of Canada. In accordance with section 8 of the *Public Pensions Reporting Act*, the Office of the Comptroller General of Canada provided a certification of the assets of the plan as at 31 March 1997.

B- Membership

1. Highlights

As at 31 March 1996, the Supplementary Death Benefit plan included 130,548 participants¹. Of this number, 66,348 were non-elective participants, 64,123 were elective participants in receipt of an immediate annuity (retirement and disability) and 77 were elective participants entitled to a deferred annuity. The total amount of death benefits insured at that date was \$8,428.7 million. Summaries of data on participants are provided in Appendix 3, starting on page 33 of this report.

2. Validation of Membership Data

The following validation tests were done to the valuation input data:

- reconciling the membership data with the data used in the previous valuation report;
- comparing the membership with that published in the Report on the Administration of the Canadian Forces Superannuation Account for the year ending 31 March 1996;

¹ See Appendix 1 (starting on page 20) for the definition of the various categories of participants.

- checking that the salary of a non-elective participant is within a certain range and reasonably consistent in comparison to the salary of that non-elective participant in the previous valuation;
- verification of the maximum insured amount of elective participants over age 70 (i.e. maximum \$5,000 paid-up benefit);
- verification that the insured benefit is reasonably consistent in comparison to the salary (at cessation of employment for elective participants).

Based on the omissions and discrepancies identified by these and other tests, appropriate adjustments were made to the basic data after consulting with the Department of National Defence who provided them.

3. Sources of Membership Data

The Department of National Defence provided relevant valuation input data on non-elective participants and elective participants. The co-operation and able assistance received from various sections of the Department of National Defence deserve to be acknowledged.

III- Methodology

A- Assets

The assets of the plan consist exclusively of the balance, recorded on a book value basis, in the RFDB Account, which forms part of the Public Accounts of Canada. The earning power of the assets corresponds to the yields, shown on page 8, that are projected on an open-group basis as described in the actuarial report as at 31 March 1997 on the pension plan for the Canadian Forces.

The Account balance corresponds to the excess of past contributions and investment earnings over past benefit payments. Assets are accordingly projected at the end of a given plan year by adding to the RFDB Account at the beginning of that plan year the net income (i.e. the excess of contributions and investment earnings over benefits) projected as described below for that plan year. Administration expenses are ignored because they are not charged to the RFDB Account.

B- Contributions

Participants' annual contributions are projected for a given plan year by multiplying the legislated contribution rates (Section C-1 of Appendix 1) by the salaries, projected for that plan year using the assumed rates of increase described in Section IV-A below (salary increases are deemed to stop at the time a non-elective participant becomes an elective participant), of participants projected for that plan year on an open-group basis as described in Section IV-C below. Furthermore, projected contributions take into account the annual 10% reduction in insured benefits from age 61 onward and the \$5,000 insurance portions paid-up by the government at age 65 (see note to this effect in Section IV-C-3).

The government's annual contribution is projected for a given plan year as the sum of one-twelfth of the total amount of death benefits (excluding the \$5,000 paid-up portions of insured benefits) projected to be paid during that plan year as described in Section D below and the total legislated single premiums (Section C-3-(b) of Appendix 1) in respect of participants reaching age 65 during that plan year.

C- Investment Earnings

Annual investment earnings are projected for a given plan year as the product of the yield projected for that plan year (Section IV-A below) and the sum of the Account projected to the beginning of that plan year plus about¹ 50% of the difference between contributions (item B above) and benefits (item D below) projected for that plan year.

D- Benefits

The total amount of death benefits (term and paid-up insurance) for a given plan year is projected as the total amount of insured death benefits in force during that plan year multiplied by the mortality rates assumed to apply during that plan year (Section IV-C-2 below). The amount of insured death benefits depends on the salary projected to time of death. Salaries are projected for this purpose using the assumed rates of increase in salaries (Section IV-A below) and the number of participants projected on an open-group basis as described in Section IV-C below.

E- Liabilities

1. In respect of the individual \$5,000 paid-up portions of insured benefits, liabilities at the end of a given plan year correspond to the amount which, together with interest at the projected yields (page 8), is sufficient to pay for each individual \$5,000 portion of insured benefit on the eventual death, projected on the basis of the assumed mortality rates (Section IV-C), of all projected participants insured as at 31 March of that plan year.
2. The margin against adverse fluctuations at the end of a given plan year is held only in respect of the insurance paid for on a term basis and corresponds to the amount which, added to the benefit payments projected for that plan year, provides a 99.5% statistical probability that actual benefit payments of that plan year will not exceed the sum of this margin and the benefit payments projected for that plan year. It is deemed equal, assuming that the distribution of the number of deaths is binomial, to 2.6 times the standard deviation in the plan year's expected amount of death benefits. For a given plan year, the standard deviation is deemed equal to the square root of the product of the plan year's expected number of deaths and the square of the plan year's average amount of insurance.

¹ The multiplying factor actually used for one half year of interest is $\left[(1+y)^{1/2} - 1\right]$, where "y" corresponds to the yield projected for the plan year.

3. On the basis of the plan's experience, the reserve at the end of a given plan year for claims incurred but not reported, and reported but not paid (IBNR/RNP), is set equal to one-sixth of the projected annual benefits paid on average during the six previous plan years.
4. Due to the negligible effect of the 30-day extension of insurance upon termination of coverage and to the nature of term insurance paid for on a monthly basis, no liability is deemed to exist in respect of that term insurance provision.

F- Membership Data

For valuation purposes, data for non-elective participants were grouped by sex, by age (last birthday) and completed number of years of service. Data for elective participants were grouped only by sex and by age (last birthday).

Due to their negligible effect on valuation results, the 77 elective participants entitled to a deferred annuity were not taken into consideration for purposes of this valuation.

The data on participants referred to in section II-B above were provided as at 31 March 1996, which is one year earlier than the valuation date of this report. These data were projected to the valuation date using the rates of termination described in the valuation as at 31 March 1997 of the pension plan established under the *Canadian Forces Superannuation Act*.

IV- Assumptions

A- Economic Assumptions

For purposes of projecting the RFDB Account to the end of each future plan year, the economic assumptions, including the assumed seniority and promotional salary increases (Tables 2A1 and 2A2 on pages 25 and 26), are those adopted for the actuarial report as at 31 March 1997 on the pension plan for the Canadian Forces. They are summarized in the following table:

Plan Year	Projected Yield on the Account (%)	Average Salary Increase ¹ (%)
1998	9.97	2.4 / 1.5 ²
1999	9.73	3.2
2000	9.47	3.4
2001	9.16	3.6
2002	8.81	3.8
2003	8.41	4.0
2004	8.14	4.0
2005	7.89	4.0
2010	6.97	4.0
2015	6.28	4.0
2020	6.02	4.0
2021+	6.00	4.0

B- Administrative Expenses

In projecting the Account, no assumption was made regarding the expenses incurred for the administration of the plan. These expenses, which are not charged to the RFDB Account, are borne entirely by the government and are commingled with all other government expenses.

¹ Assumed to be effective as at 1 April and exclusive of the seniority and promotional increases.

² Salary increases of 2.4% and 1.5% were actually granted to Officers and Other Ranks, respectively, as at 1 April 1997.

C- Demographic Assumptions

Except where otherwise noted, all demographic assumptions were determined from the plan's own experience as was done in the past. Therefore, assumptions of the previous valuation were appropriately updated to reflect the experience of January 1994 to March 1997. As for the previous valuation, demographic assumptions were grouped on a *last* basis, i.e. age and years of service were rounded to the next lower integer.

1. New Non-Elective Participants

The projection of future new non-elective participants (defined in section A-1 of Appendix 1) is required in the valuation process because this valuation is done on an open-group basis (i.e. assets and liabilities are estimated at the end of each plan year of the projection period taking into account future new participants to the plan). The assumptions used for this purpose are the same as those in the actuarial report as at 31 March 1997 on the pension plan for the Canadian Forces and are briefly described below.

For each future plan year and each group of members, the number of new non-elective participants was assumed equal to the assumed number of all terminations so as to obtain a constant regular force from 31 March 1997 onward.

For Officers and Other Ranks, the assumed age distribution of future new non-elective participants was derived separately by sex consistent with that of actual new non-elective participants during the 1996 plan year.

2. Mortality Rates and Longevity Improvement Factors

Mortality rates are used for both the computation of death benefits and the survivorship of the participants beyond the valuation date.

(a) Non-Elective Participants

The mortality rates deemed to apply in 1998 plan year were set equal to the mortality rates assumed for contributors for 1998 in the actuarial report as at 31 March 1997 of the CFSA. Separate rates apply for males and females (Table 2E, page 29).

Mortality rates after 1998 were derived from the 1998 rates by assuming for each age constant annual percentage decreases in such rates. Sample longevity improvement factors are shown in Table 2H on page 32.

(b) Elective Participants (Retirement and Disability) in Receipt of an Immediate Annuity

The mortality rates deemed to apply in plan year 1998 were set equal to the mortality rates assumed for pensioners (retirement and disability) for 1998 in the actuarial report as at 31 March 1997 of the CFSA. These assumptions are described below.

In respect of elective retirement participants (i.e. retirement pensioners in the actuarial report as at 31 March 1997 of the CFSA) assumed mortality rates were derived separately for male Officers, male Other Ranks and females. On the basis of the plan's experience, the mortality rates assumed for males in the previous valuation for 1995 were maintained but projected three years to account for longevity improvements from 1995 to 1998. For females, the GAM 1994 Basic Table had been assumed for 1994 in the previous valuation. On the basis of the plan's experience regarding female mortality, the GAM 1994 Static Table is assumed for plan year 1998 in this report as it includes a 7% margin over the Basic Table. See Table 2F on page 30 for sample values of the assumed mortality rates.

In respect of elective disability participants (i.e. disability pensioners in the actuarial report as at 31 March 1997 of the CFSA), mortality rates were derived separately by sex, Officers and Other Ranks. The previous valuation assumptions for 1995 were based on the Life Tables, Canada, for 1985-87 projected five years for longevity improvements. On the basis of the plan's experience, 1998 rates for both female groups are the same as those used for 1995 in the previous valuation, but projected three additional years for longevity improvements. Rates for male Other Ranks were adjusted by giving 50% credibility to the previous valuation assumption and 50% credibility to the 1994-96 experience. Rates for male Officers were adjusted by giving 65% credibility to the previous valuation assumption and 35% credibility to the 1994-96 experience (Table 2G on page 31).

Mortality rates for 1999 and later years were adjusted using the same longevity improvement factors used for non-elective participants.

3. Other Demographic Assumptions

For non-elective participants, the termination rates were set equal to those assumed for contributors in the actuarial report as at 31 March 1997 of the CFSA (Tables 2B to 2D on pages 27 to 29). It was assumed, *inter alia*, that:

- (a) all non-elective participants would leave service by their 60th birthday (the individual \$5,000 portion of insurance are accordingly assumed to become paid-up by the government at age 65 in all cases); and
- (b) terminations without right to a pension, pensionable disabilities and retirements were permanent and that therefore no subsequent re-entry would occur.

4. Coverage Elections and Options

- (a) The valuation data indicate that the proportion of elective participants, in receipt of an immediate annuity, electing not to continue their coverage under the RFDB is negligible. Accordingly, all such elective participants were assumed to continue coverage when they cease to serve in the Canadian Forces.
- (b) The valuation data indicate that the percentage of elective participants opting to reduce their amount of insured death benefit to \$5,000 is negligible. Accordingly, no elective participants were assumed to make such an option.

V- Results**A- Balance Sheet as at 31 March 1997**

The following balance sheet was prepared using the data described in Section II, the methodology described in Section III and the assumptions described in Section IV.

	(\$ millions)
<u>Assets</u>	172.1
<u>Liabilities</u>	
Actuarial liability in respect of the paid-up insured death benefit for participants at ages 65 and over	51.6
Reserve for claims incurred but unreported, and for claims reported but not paid	3.8
Margin against adverse fluctuations	<u>3.1</u>
Total liabilities	58.5
<u>Surplus</u>	113.6

B- Comparing Benefit Cost Rates to Legislated Contribution Rates

1. Short Term

The aggregate amount of death benefit payments projected for plan year 1998 is \$30.4 million, that is \$24.7 million in respect of the term insurance (two times annual salary) and \$5.7 million in respect of the paid-up insurance (individual \$5,000 portions).

(a) Paid-Up Insurance

For plan year 1998, the estimated single premium at age 65 for each \$5,000 of insured benefit is \$1,679 and \$1,270 for males and females, respectively. The corresponding legislated contribution rates (item 3(b) on page 22) for each \$5,000 of paid-up insured benefits are \$310 and \$291, respectively.

(b) Term Insurance

The amount of total benefits projected to be paid during plan year 1998 is \$24.7 million. Considering the total amount of insured benefits of \$8,410.8 million projected for plan year 1998, the benefit cost rate projected for plan year 1998 is \$0.245 per month per \$1,000 of insured benefit, i.e. $\$1,000 * \$24.7 / \$8,410.8 / 12$.

Non-elective participants and elective participants in receipt of an immediate annuity are required to contribute monthly \$0.20 per \$1,000 of salary or, \$0.099¹ per \$1,000 of insured benefit. As a minimum, the government contributes monthly an amount equal to one-twelfth of the actual total amount of death benefits payable during the month (excluding the \$5,000 paid-up portion). For plan year 1998, the government's monthly contribution is estimated at \$0.020 per \$1,000 of insured benefit, i.e. $\$0.245 / 12$.

Therefore, the total amount contributed by participants and the government is \$0.120 ($\$0.099 + \0.020 plus rounding adjustment) per month per \$1,000 of insured benefit, i.e. less than half the estimated monthly cost (second paragraph above) of \$0.245 per \$1,000 of insured benefit for plan year 1998.

¹ If it were not for the rounding to the next lower multiple of \$250 of salary involved in the computation of contributions and the rounding to the next higher multiple of \$250 involved in the computation of the amount of insurance (twice the salary), the legislated contribution rate would be \$0.10 (i.e. \$0.20 divided by two) instead of \$0.099.

2. Long Term

(a) Paid-Up Insurance

The assumed improvements in longevity cause the projected single premium for the paid-up insurance to decrease over time. However, the projected ultimate yield of 6.0% is lower than the yield of 9.97% projected for plan year 1998. This has the effect of increasing gradually the projected single premium over the years. The net effect of longevity improvements and decreasing projected yields, on the projected single premiums at age 65 for each \$5,000 of insured benefit, is for males a decrease from \$1,679 for plan year 1998 to \$1,541 for plan year 2050, and for females an increase from \$1,270 to \$1,367. The corresponding legislated contribution rates (item 3(b) on page 22) for each \$5,000 of paid-up insured benefits are \$310 and \$291, respectively.

(b) Term Insurance

The monthly benefit cost rate per \$1,000 of term insurance is projected to decrease gradually from \$0.245 for plan year 1998 to \$0.123 for plan year 2050. This \$0.123 cost rate compares to the combined (government and participants) legislated contribution rate of \$0.109 (i.e. \$0.099 for participants plus one-twelfth of \$0.123 for government plus rounding adjustment) projected for plan year 2050.

The following table illustrates the projected monthly benefit cost rates per \$1,000 of insured death benefit for selected plan years.

**Projected Monthly Benefit Cost Rates
(per \$1,000 of Insured Death Benefit)**

	Plan Year				
	1998	2000	2010	2025	2050
Non-Elective Participants	0.082	0.083	0.080	0.065	0.048
Elective Participants	0.508	0.511	0.441	0.468	0.286
All Participants	0.245	0.244	0.211	0.191	0.123

For non-elective participants, the monthly cost projected for plan year 2050 is 59% of the monthly cost estimated for 1998. This results mainly from the following two factors:

- i) There is a significant reduction in cost due to the assumed lower mortality for plan year 2050 in accordance with the longevity improvement factors shown in Table 2H on page 32 applied to the current mortality rates shown in Table 2E on page 29.
- ii) The distribution of non-elective participants in the plan year 2050 is weighted more heavily at the older ages than currently. This has the effect of increasing costs. However, this increase is more than offset by the effect of assumed mortality improvements.

For elective participants in receipt of an immediate annuity, the monthly benefit cost rate projected for plan year 2050 is 56% of the monthly benefit cost rate estimated for plan year 1998. This reduction is mostly the result of assumed mortality improvements.

In aggregate, for non-elective participants and elective participants in receipt of an immediate annuity, the monthly benefit cost rate projected for 2050 is 50% of the monthly benefit cost rate estimated for plan year 1998.

C- Vanishing Surplus and Account

1. Short Term

The surplus was \$113.6 million as at 31 March 1997. It corresponds to 3.7 times the total amount of death benefits projected for plan year 1998. By comparison, the surplus as at 31 December 1993 under the previous report was \$108.3 million. It also corresponded to 3.7 times the amount of death benefits payable during calendar year 1994.

2. Long Term

As shown in section F below and explained in section B above, the projected participants' and government's contributions are less than the projected benefits for each future plan year regarding both the term and the paid-up insurance.

This projected annual shortfall is greater than the projected annual investment earnings on the Account and accordingly entails a continuously decreasing surplus. The surplus is therefore projected to become a deficit after plan year 2007, while the Account is projected to become exhausted in plan year 2015.

D- Sensitivity of Valuation Results to Variations in Key Assumptions

The following supplementary estimates indicate the degree to which some of the valuation results depend on some of the key assumptions. The differences between the results below and those shown in sections B, C and F can also serve as a basis for approximating the effect of other numerical variations in a key assumption, to the extent that such effects are indeed linear.

1. Projected Investment Yields

The valuation reflects a deemed investment policy of buying and holding until maturity long-term Government of Canada bonds. If the investment portfolio also included a significant equity component, it would be appropriate to project higher rates of return. As a measure of sensitivity, an increment of one percentage point in the projected yields would change from 2015 to 2016 the fiscal year during which the Account is projected to become exhausted.

2. Mortality

If the mortality rates assumed in each future year were reduced by 10%, then the monthly benefit cost rate of \$0.123 projected for 2050 would be reduced in the same proportion to \$0.111.

If the assumed improvements in longevity after the 1997 plan year were disregarded, then the monthly benefit cost rate of \$0.123 projected for 2050 would climb to \$0.284.

E- Reconciliation of Results with Previous Report

In the previous report, the monthly benefit cost rate was projected at \$0.142 per \$1,000 of term insurance for plan year 2050. The following table indicates that the revised assumed mortality improvements are the main reason for the decrease from \$0.142 to \$0.123 of that projected benefit cost rate.

	Monthly Benefit Cost Rate Projected for 2050 Plan Year per \$1,000 of Term Insurance (excluding paid-up insurance)
As at 31 December 1993	\$0.142
Move to plan year basis	0.003
Intervaluation economic experience	0.002
Changes in assumed base year mortality rates	(0.002)
Changes in assumed longevity improvement factors	(0.023)
Changes in termination rates (other than mortality rates)	0.003
Changes in economic assumptions	(0.002)
As at 31 March 1997	\$0.123

F- Account Projection

The Account projection shown on the next page was prepared using the data described in Section II, the methodology described in Section III and the assumptions described in Section IV. Figures are expressed in thousands of dollars and negative amounts are shown in brackets.

Income and Expenditure During the Plan Year

Plan Year	Investment Earnings	Contributions							Balance Sheet at the End of the Plan Year					
		Participants	Government			Benefit Payments			Account	Liabilities				Surplus
			Term	Paid-up	Total	Term	Paid-up	Total		Paid-up	IBNR/RNP	Margin	Total	
1997	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	172,074	51,566	3,795	3,085	58,446	113,628
1998	16,295	10,111	2,059	644	12,814	24,706	5,747	30,453	170,730	55,352	4,126	3,241	62,719	108,011
1999	15,751	10,339	2,107	612	13,058	25,288	5,953	31,241	168,298	58,915	4,506	3,401	66,822	101,476
2000	15,070	10,625	2,156	636	13,417	25,876	6,209	32,085	164,701	62,593	4,899	3,565	71,057	93,644
2001	14,228	10,944	2,204	638	13,786	26,449	6,427	32,876	159,840	66,168	5,337	3,723	75,228	84,612
2002	13,238	11,306	2,253	629	14,188	27,037	6,589	33,626	153,639	69,492	5,606	3,864	78,962	74,677
2003	12,117	11,708	2,303	621	14,632	27,635	6,687	34,322	146,067	72,522	5,920	4,000	82,442	63,625
2004	11,101	12,148	2,354	617	15,119	28,246	6,696	34,942	137,344	75,377	6,078	4,131	85,586	51,758
2005	10,064	12,617	2,403	594	15,614	28,840	6,798	35,638	127,384	77,939	6,226	4,242	88,407	38,977
2006	8,995	13,119	2,453	607	16,179	29,440	6,858	36,298	116,259	80,379	6,362	4,360	91,101	25,158
2007	7,933	13,654	2,506	580	16,740	30,076	6,953	37,029	103,904	82,479	6,491	4,487	93,457	10,447
2008	6,850	14,220	2,565	616	17,401	30,774	7,061	37,835	90,320	84,691	6,620	4,617	95,928	(5,608)
2009	5,714	14,812	2,624	596	18,032	31,487	7,176	38,663	75,403	86,630	6,753	4,753	98,136	(22,733)
2010	4,538	15,436	2,686	513	18,635	32,237	7,323	39,560	59,016	87,847	6,894	4,899	99,640	(40,624)
2011	3,312	16,096	2,755	476	19,327	33,064	7,439	40,503	41,152	88,652	7,042	5,060	100,754	(59,602)
2012	2,016	16,784	2,832	629	20,245	33,979	7,540	41,519	21,894	90,267	7,201	5,234	102,702	(80,808)
2013	727	17,493	2,913	629	21,035	34,957	7,661	42,618	1,038	91,766	7,371	5,423	104,560	(103,522)
2014	33	18,229	3,005	594	21,828	36,061	7,772	43,833	0	92,880	7,554	5,627	106,061	(106,061)
2020	0	23,070	3,753	613	27,436	45,032	8,107	53,139	0	94,865	8,995	7,061	110,921	(110,921)
2025	0	27,345	4,330	944	32,619	51,959	8,460	60,419	0	105,514	10,487	8,186	124,187	(124,187)
2030	0	32,142	4,412	932	37,486	52,939	9,046	61,985	0	121,953	11,322	9,326	142,601	(142,601)
2035	0	38,993	4,515	548	44,056	54,180	9,393	63,573	0	125,430	11,498	11,042	147,970	(147,970)
2040	0	48,528	5,241	348	54,117	62,887	9,677	72,564	0	122,326	12,420	13,380	148,126	(148,126)
2045	0	60,075	6,365	493	66,933	76,374	10,051	86,425	0	117,858	14,560	15,919	148,337	(148,337)
2050	0	73,099	7,400	573	81,072	88,800	10,369	99,169	0	113,512	17,081	18,553	149,146	(149,146)

VI- Conclusions

A- Surplus

The plan's surplus estimated as at 31 March 1997 is large. However, the surplus is projected to become a deficit after plan year 2007. The financial projections of this report therefore indicate that, barring changes to amounts of insured benefits, the current contribution rates would need to be increased by plan year 2008. Otherwise, the government would have to make special contributions beginning in plan year 2015 when the Account balance turns negative.

B- Actuarial Standards

In my opinion, considering that this report was prepared pursuant to the *Public Pensions Reporting Act*,

- the valuation data on which it is based are sufficient and reliable;
- the assumptions that have been used are, in aggregate, appropriate;
- the methodology employed is appropriate; and
- the value of the plan assets would be greater than the liabilities if the plan were to be wound up at the valuation date.

This report has been prepared, and my opinion given, in accordance with accepted actuarial practice, and particularly with the Recommendations of the Canadian Institute of Actuaries for Actuarial Advice given with respect to Self-Insured Employee Benefit Plans.

Bernard Dussault, B.Sc., F.S.A., F.C.I.A.
Chief Actuary
Public Insurance and Pension Programs

Ottawa, Canada
27 February 1998

APPENDIX 1

Summary of Plan Provisions

Following is a summary description of the main provisions of the life insurance plan established for the members of the regular force under Part II - *Supplementary Death Benefit of the Canadian Forces Superannuation Act* (CFSA). This plan supplements the pension plan covering the members of the regular force by providing a lump sum benefit upon the death of an insured member.

A- Membership

1. Non-Elective Participants

Non-elective participant means a member of the regular force, or a member of the reserve force who is, with the approval of the Chief of the Defence Staff, on full-time service in a position in a regular force establishment or as a supernumerary to a regular force establishment.

2. Elective Participants

Elective participant means all previously non-elective participants who have ceased to be employed in the Canadian Forces by reason of disability or retirement (i.e. when they become entitled to an immediate retirement or disability annuity) and elected to continue coverage under the Regular Forces Supplementary Death Benefit (RFSDB) plan. Such right is limited to members who, at the time they cease to be employed in the Canadian Forces, had completed at least five years of continuous service in the Canadian Forces or five years of membership in the RFSDB plan.

Elective participants entitled to a deferred annuity under the CFSA upon cessation of employment may elect to continue their full coverage under the RFSDB plan; otherwise their membership and coverage is discontinued. This election must be made within the 13-month period running from one year before to the 30th day following cessation of employment. The insured death benefit is extended for 30 days after the date of cessation whether or not a participant exercises the right of election for continuous coverage.

An elective participant who becomes a participant in the Public Service Supplementary Death Benefit (PSSDB) plan automatically ceases to be a participant in the RFSDB. Any such person who subsequently ceases to be a participant in the PSSDB plan, without entitlement to an immediate annuity under the *Public Service Superannuation Act*, is deemed thereupon to regain the status of elective participant in the RFSDB.

B- Assets

The plan is financed through the RFDB Account, which forms part of the Public Accounts of Canada. The Account is credited with all contributions made by the participants and the government, and charged with all benefit payments when they become due. The Account is also credited with investment earnings at the investment yields applying to the Canadian Forces Superannuation Account. No formal debt instrument is issued by the government to the RFDB Account in recognition of the amounts therein.

C- Contributions

1. Non-Elective Participants, and Elective Participants in Receipt of an Immediate Annuity

For non-elective participants, and for elective participants in receipt of an immediate annuity under Part I of the CFSA or the *Defence Services Pension Continuation Act* (DSPCA) on ceasing to be employed in the regular force, the rate of contribution is \$0.05 per month for each \$250 of salary (for this purpose the salary is in practice rounded to the next lower multiple of \$250 if not already equal to such a multiple). At attainment of age 65 (or completion of five years of service, if later), the total contribution is reduced by \$0.50 per month in recognition of the fact that a \$5,000 portion of the insured death benefit becomes paid-up (by the government) for the remaining lifetime of the participant.

2. Elective Participants Entitled to a Deferred Annuity

For elective participants entitled to a deferred annuity, the legislated contribution rate varies in accordance with the attained age of the participant, and the corresponding contributions start being chargeable on the 30th day immediately following cessation of employment. The adjacent table shows the legislated rates for quinquennial ages:

Age Last Birthday	Contribution per \$2,000 of Insured Benefit	
	Annual	Monthly
25	\$ 9.70	\$ 0.82
30	11.42	0.97
35	13.58	1.15
40	16.29	1.39
45	19.72	1.67
50	24.11	2.05
55	29.80	2.53
60	37.65	3.20

3. Government

(a) Term Insurance

The government credits monthly to the RFDB Account an amount equal to one-twelfth of the total amount of death benefits actually payable (excluding the individual \$5,000 paid-up portions of insured benefits) in respect of all participants deceasing during that month.

(b) Paid-Up Insurance

When a participant, other than one entitled to a deferred annuity, reaches age 65 (or completes five years of service, if later), the government credits to the RFDB Account a single premium for the individual \$5,000 paid-up portion of insured benefit in respect of which contributions are no longer required from the participant.

The legislated amount of single premium for each such \$5,000 paid-up portion of insured benefit is shown in the adjacent table and corresponds to one-tenth of \$5,000 times the single premium rate, for each dollar of insured benefit, computed on the basis of the Life Tables, Canada, 1950-1952 and interest at 4% per annum.

Age Nearest Birthday	Single Premium per \$5,000 of Insured Benefit	
	Males	Females
65	\$310	\$291
66	316	298
67	323	306
68	329	313
69	336	320
70	343	328
71	349	335
72	356	342
73	362	349
74	369	356
75	375	363

(c) Cash Shortfalls

Under the statutes, if for whatever reason the RFDB Account were to become exhausted, the government would then have to make special contributions to the Account in an amount at least equal to the benefits then due but not paid by reason of such cash shortfall.

D- Investment Earnings

Investment earnings are credited every three months to the Account at a rate of return equal to the average yield applying for the corresponding period to the combined Superannuation Accounts of the Public Service, Canadian Forces, and Royal Canadian Mounted Police pension plans. The investment portfolio underlying those three Accounts consists of notional bonds bearing interest as under the Canada Pension Plan, i.e. at the average rate on outstanding Government of Canada bonds with 20 or more years to maturity.

E- Amount of Insured Death Benefit

Subject to the applicable reductions described below, the lump sum benefit payable upon the death of a participant is equal to the participant's current salary multiplied by two, the result being rounded to the next higher multiple of \$250 if not already equal to such a multiple. For this purpose, the current salary of an elective participant is defined as the annual rate of pay at the time of cessation of employment in the Canadian Forces. Moreover, for this purpose, in respect of both non-elective participants and elective participants, the annual salary is taken as not less than \$3,000 for rank lower than warrant officer, and \$5,000 for warrant officer rank or higher.

The amount of insurance described above is reduced by 10% a year starting at age 61 until it would normally vanish at age 70. However, except for elective participants entitled to a deferred annuity, the amount of insurance cannot at any time be reduced below a basic floor value of \$5,000 subject to the following exception:

For those elective participants who had, upon cessation of employment prior to the enactment of Bill C-55, made an election to reduce their insured death benefit to \$500 and further had made within one year following the introduction of Bill C-55 a second election to keep their insured death benefit at \$500, the floor value is \$500 instead of \$5,000. Such election is irrevocable.

Upon ceasing to be employed in the regular force, elective participants in receipt of an immediate annuity under the CFSA may opt to reduce their amount of insured death benefit to \$5,000.

APPENDIX 2

Sample Demographic Assumptions

Table 2A1

**Annual Seniority and Promotional Salary Increases
For Officers**

Service ¹	Plan Year				Service ¹	Plan Year			
	Experienced		Assumed			Experienced		Assumed	
	1991-94 (%)	1995-96 (%)	1997-99 (%)	2000+ (%)		1991-94 (%)	1995-96 (%)	1997-99 (%)	2000+ (%)
0	11.2	4.1	13.4	13.4	20	1.5	0.4	1.5	1.4
1	16.2	4.3	16.7	16.6	21	1.4	0.4	1.4	1.3
2	18.4	8.8	18.2	18.0	22	1.4	0.5	1.3	1.2
3	19.9	14.1	19.9	19.7	23	1.2	0.4	1.2	1.1
4	16.7	15.2	16.7	16.5	24	1.1	0.4	1.2	1.0
5	12.0	12.3	12.5	12.3	25	1.0	0.3	1.0	0.9
6	8.6	7.9	8.8	8.6	26	1.0	0.3	1.0	0.9
7	6.2	4.2	6.3	6.2	27	0.9	0.3	0.9	0.8
8	5.2	2.9	5.2	5.1	28	0.8	0.3	0.8	0.7
9	4.2	2.2	4.2	4.1	29	0.8	0.3	0.8	0.7
10	3.5	1.5	3.7	3.6	30	0.7	0.3	0.7	0.7
11	3.2	1.3	3.5	3.4	31	0.7	0.3	0.8	0.7
12	3.0	1.2	3.2	3.1	32	0.6	0.3	0.8	0.7
13	2.7	1.1	2.8	2.7	33	0.6	0.3	0.6	0.6
14	2.3	1.1	2.4	2.3	34	0.6	0.3	0.6	0.6
15	2.0	1.0	2.1	2.0	35	0.5	0.2	0.6	0.6
16	1.7	0.8	1.7	1.7	36	0.5	0.2	0.6	0.6
17	1.6	0.7	1.7	1.6	37	0.4	0.1	0.5	0.5
18	1.6	0.6	1.6	1.5	38	0.3	0.0	0.4	0.4
19	1.5	0.5	1.6	1.5	39	0.4	0.0	0.3	0.3
					40 and over	0.0	0.0	0.0	0.0

¹ Expressed in completed years.

Table 2A2

**Annual Seniority and Promotional Salary Increases
For Other Ranks**

Service ¹	Plan Year				Service ¹	Plan Year			
	Experienced		Assumed			Experienced		Assumed	
	1991-94 (%)	1995-96 (%)	1997-99 (%)	2000+ (%)		1991-94 (%)	1995-96 (%)	1997-99 (%)	2000+ (%)
0	18.7	12.3	19.2	19.2	20	1.0	0.4	1.2	1.2
1	18.0	13.9	19.4	15.8	21	1.0	0.4	1.2	1.2
2	16.9	13.9	18.6	12.7	22	1.0	0.5	1.2	1.2
3	13.9	11.6	13.8	10.0	23	1.0	0.5	1.1	1.1
4	8.5	7.6	10.2	7.8	24	0.9	0.4	1.1	1.1
5	4.0	4.2	7.4	5.9	25	0.9	0.4	1.1	1.1
6	2.0	1.7	5.4	4.4	26	0.8	0.4	1.0	1.0
7	1.4	0.7	3.8	3.2	27	0.8	0.3	1.0	1.0
8	1.0	0.6	2.7	2.3	28	0.8	0.3	1.0	1.0
9	0.7	0.5	1.9	1.7	29	0.7	0.3	1.0	1.0
10	0.6	0.4	1.4	1.3	30	0.7	0.3	1.0	1.0
11	0.6	0.4	1.2	1.0	31	0.7	0.2	0.9	0.9
12	0.6	0.3	1.0	1.0	32	0.6	0.2	0.9	0.9
13	0.7	0.3	1.0	0.9	33	0.6	0.2	0.9	0.9
14	0.8	0.3	1.0	1.0	34	0.7	0.2	0.9	0.9
15	0.8	0.4	1.1	1.1	35	0.6	0.2	0.8	0.8
16	0.8	0.4	1.1	1.1	36	0.6	0.3	0.8	0.8
17	0.9	0.4	1.2	1.2	37	0.5	0.3	0.7	0.7
18	1.0	0.4	1.2	1.2	38	0.0	0.0	0.6	0.6
19	1.0	0.4	1.2	1.2	39	0.0	0.0	0.6	0.5
					40 and over	0.0	0.0	0.0	0.0

¹ Expressed in completed years.

Table 2B**Assumed Rates of Termination for Non-Elective Participants
With Less Than 20 Years of Service**

Service ¹	Officers		Other Ranks	
	Male	Female	Male	Female
0	0.082	0.094	0.021	0.038
1	0.065	0.074	0.052	0.069
2	0.048	0.060	0.119	0.090
3	0.033	0.049	0.090	0.086
4	0.024	0.049	0.061	0.076
5	0.027	0.060	0.056	0.072
6	0.042	0.076	0.051	0.068
7	0.054	0.086	0.045	0.063
8	0.055	0.086	0.036	0.059
9	0.045	0.076	0.030	0.055
10	0.034	0.061	0.028	0.051
11	0.027	0.049	0.024	0.046
12	0.023	0.039	0.020	0.039
13	0.019	0.033	0.016	0.032
14	0.015	0.027	0.013	0.024
15	0.013	0.023	0.011	0.018
16	0.014	0.020	0.008	0.014
17	0.017	0.018	0.006	0.012
18	0.024	0.017	0.002	0.012
19 and over	n/a	n/a	n/a	n/a

¹ Expressed in completed years.

Table 2C**Assumed Rates of Termination for Non-Elective Participants
With 20 or More Years of Service**

<u>Service¹</u>	<u>Officers</u>	<u>Other Ranks</u>
18 and under	n/a	n/a
19	0.043	0.057
20	0.056	0.057
21	0.062	0.053
22	0.061	0.058
23	0.058	0.097
24	0.059	0.137
25	0.064	0.132
26	0.076	0.116
27	0.091	0.120
28	0.103	0.138
29	0.111	0.175
30	0.115	0.207
31	0.121	0.226
32	0.146	0.240
33	0.202	0.274
34	0.278	0.342
35	0.338	0.420
36	0.381	0.507
37	0.407	0.604
38 and over	0.417	0.604

¹ Expressed in completed years.

Table 2D**Sample of Assumed Rates of Termination due to Disability¹**

Age Last Birthday	Male		Female
	Officers	Other Ranks	Officers / Other Ranks
15	0.0004	0.0117	0.0021
20	0.0032	0.0063	0.0045
25	0.0020	0.0038	0.0045
30	0.0009	0.0027	0.0037
35	0.0006	0.0032	0.0039
40	0.0009	0.0054	0.0053
45	0.0014	0.0086	0.0075
50	0.0035	0.0142	0.0108
55	0.0051	0.0227	0.0156
59	0.0051	0.0313	0.0206

Table 2E**Sample of Assumed Mortality Rates Deemed Applicable in Plan Year 1998
in Respect of Non-Elective Participants**

Age Last Birthday	Males	Females
15	0.0004	0.0002
20	0.0004	0.0002
25	0.0005	0.0003
30	0.0007	0.0004
35	0.0009	0.0004
40	0.0012	0.0006
45	0.0017	0.0012
50	0.0024	0.0018
55	0.0041	0.0027
59	0.0074	0.0045

¹ Disability is assumed to be permanent with no recovery possible.

Table 2F**Sample of Assumed Mortality Rates Deemed Applicable in Plan Year 1998
in Respect of Elective Retirement Participants**

Age Last Birthday	Male		Female
	Officers	Other Ranks	Officers / Other Ranks
20	0.0004	0.0004	0.0003
25	0.0004	0.0006	0.0003
30	0.0005	0.0009	0.0004
35	0.0007	0.0012	0.0005
40	0.0011	0.0020	0.0007
45	0.0017	0.0025	0.0010
50	0.0030	0.0042	0.0014
55	0.0048	0.0074	0.0024
60	0.0085	0.0120	0.0047
65	0.0142	0.0197	0.0091
70	0.0210	0.0325	0.0144
75	0.0379	0.0504	0.0236
80	0.0644	0.0739	0.0411
85	0.1018	0.1083	0.0708
90	0.1535	0.1615	0.1228
95	0.2260	0.2338	0.1973
100	0.3198	0.3264	0.2939
105	0.4957	0.4957	0.4152
110	1.0000	1.0000	0.4924

Table 2G**Sample of Assumed Mortality Rates Deemed Applicable in Plan Year 1998
in Respect of Elective Disability Participants**

Age Last Birthday	Male		Female	
	Officers	Other Ranks	Officers	Other Ranks
15	0.0008	0.0004	0.0004	0.0005
20	0.0008	0.0004	0.0004	0.0005
25	0.0008	0.0008	0.0004	0.0006
30	0.0008	0.0027	0.0005	0.0007
35	0.0010	0.0047	0.0007	0.0009
40	0.0013	0.0066	0.0010	0.0013
45	0.0034	0.0082	0.0018	0.0023
50	0.0090	0.0098	0.0030	0.0038
55	0.0153	0.0139	0.0048	0.0062
60	0.0212	0.0212	0.0076	0.0097
65	0.0280	0.0316	0.0119	0.0151
70	0.0379	0.0511	0.0189	0.0241
75	0.0554	0.0751	0.0311	0.0395
80	0.0877	0.0981	0.0524	0.0667
85	0.1413	0.1311	0.0910	0.1159
90	0.2210	0.1888	0.1561	0.1986
95	0.3281	0.2749	0.2557	0.3255
100	0.4622	0.3896	0.3686	0.4691
105	0.6280	0.5000	0.9321	1.0000
110	1.0000	0.5000	1.0000	1.0000

Table 2H**Sample of Assumed Improvements in Longevity After Plan Year 1998**

Age Last Birthday	Annual Reduction in Plan Year 1998 Assumed Mortality Rates	
	Males	Females
15	0.0215	0.0185
20	0.0215	0.0185
25	0.0125	0.0165
30	0.0075	0.0125
35	0.0075	0.0135
40	0.0105	0.0175
45	0.0155	0.0185
50	0.0205	0.0195
55	0.0215	0.0105
60	0.0185	0.0075
65	0.0165	0.0075
70	0.0175	0.0075
75	0.0165	0.0105
80	0.0125	0.0095
85	0.0095	0.0085
90	0.0065	0.0055
95	0.0045	0.0045
100	0.0035	0.0035
105 and over	0.0000	0.0000

APPENDIX 3

Summaries of Participants Data

Table 3A1

Non-Elective Participants as at 31 March 1996						
Officers						
Age Last Birthday	Number			Insured Benefit (\$ thousands)		
	Male	Female	Total	Male	Female	Total
0- 24	1,555	403	1,958	58,777	14,473	73,250
25- 29	1,945	336	2,281	166,887	28,615	195,502
30- 34	2,997	366	3,363	302,169	36,438	338,607
35- 39	2,545	230	2,775	291,617	25,132	316,749
40- 44	1,762	141	1,903	221,061	16,766	237,827
45- 49	1,373	98	1,471	182,946	11,947	194,893
50- 54	724	20	744	101,970	2,751	104,721
55- 59	34	0	34	5,375	0	5,375
Total	12,935	1,594	14,529	1,330,804	136,122	1,466,924

Officers			
	Male	Female	Total
Average Age Last Birthday	35.1	30.9	34.6
Average Completed Years of Service	14.4	9.6	13.9
Average Insured Benefit (\$)	102,884	85,396	100,965

Table 3A2

Non-Elective Participants as at 31 March 1996						
Other Ranks						
Age Last Birthday	Number			Insured Benefit (\$ thousands)		
	Male	Female	Total	Male	Female	Total
0- 24	4,414	403	4,817	236,090	24,107	260,197
25- 29	9,730	1,269	10,999	668,419	87,759	756,178
30-34	13,898	1,843	15,741	1,033,395	134,573	1,167,968
35-39	10,184	1,440	11,624	802,461	109,954	912,415
40- 44	4,611	483	5,094	388,701	38,437	427,138
45- 49	2,646	120	2,766	240,929	10,120	251,049
50- 54	757	12	769	72,345	1,048	73,393
55- 59	9	0	9	795	0	795
Total	46,249	5,570	51,819	3,443,134	405,999	3,849,133

Other Ranks			
	Male	Female	Total
Average Age Last Birthday	33.3	32.7	33.2
Average Completed Years of Service	13.0	11.8	12.9
Average Insured Benefit (\$)	74,448	72,890	74,281

Table 3B

Elective Disability Participants as at 31 March 1996						
Age Last Birthday	Number			Insured Benefit (\$ thousands)		
	Male	Female	Total	Male	Female	Total
30- 34	17	3	20	1,279	216	1,495
35- 39	27	5	32	2,058	384	2,442
40- 44	33	8	41	2,329	541	2,870
45- 49	90	8	98	3,980	633	4,613
50- 54	255	3	258	8,342	234	8,576
55- 59	492	1	493	11,456	43	11,499
60- 64	789	1	790	11,191	13	11,204
65- 69	773	4	777	5,003	33	5,036
70- 74	585	3	588	2,925	15	2,940
75- 79	252	1	253	1,260	5	1,265
80- 84	50	0	50	250	0	250
85- 89	2	0	2	10	0	10
Total	3,365	37	3,402	50,082	2,117	52,199

	Male	Female	Total
Average Age Last Birthday	63.9	49.5	63.8
Average Insured Benefit (\$)	14,883	57,219	15,344

Table 3C

Elective Retirement Participants as at 31 March 1996						
Age Last Birthday	Number			Insured Benefit (\$ thousands)		
	Male	Female	Total	Male	Female	Total
25- 29	36	13	49	3,103	1,118	4,221
30- 34	766	199	965	60,594	15,424	76,018
35- 39	1,938	314	2,252	155,314	23,749	179,063
40- 44	3,097	301	3,398	257,969	25,016	282,985
45- 49	5,896	247	6,143	496,514	21,001	517,515
50- 54	8,189	105	8,294	676,471	8,944	685,415
55- 59	10,231	112	10,343	714,313	9,278	723,591
60- 64	9,903	65	9,968	425,103	3,525	428,628
65- 69	7,234	57	7,291	95,718	1,023	96,741
70- 74	6,116	28	6,144	30,537	135	30,672
75- 79	4,080	27	4,107	20,395	130	20,525
80- 84	1,478	15	1,493	7,390	70	7,460
85- 89	242	2	244	1,210	10	1,220
90- 94	29	0	29	145	0	145
95- 99	1	0	1	5	0	5
Total	59,236	1,485	60,721	2,944,783	109,425	3,054,208

	Male	Female	Total
Average Age Last Birthday	59.3	45.7	58.9
Average Insured Benefit (\$)	49,713	73,687	50,299

Table 3D

**Elective Participants¹ Entitled to a Deferred Annuity
as at 31 March 1996**

Number	Insured Benefits (\$ thousands)
77	6,203

¹ Were disregarded for this valuation.