Solution 1

a) Discuss the advantages and disadvantages to NOC of joining the proposed plan.

Advantages

- Pension cost fixed by collective agreement
- In case of a deficiency, benefits can be reduced
- Even in excess surplus, employer contributes to the plan and receives a tax deduction
- Pension expense is more stable since equal to employer contribution
- No surplus ownership issues
- Economies of scale pertaining to the cost of sponsoring the plan
- Stable contribution requirements

Disadvantages

- No opportunity to gain from experience gains
- Employer cross subsidies (low cost subsidize high cost ers)
- Members' accrued benefits can be reduced if deficiencies

b) Explain how the actuarial assumptions for the proposed plan would likely differ from those currently used for the Hourly Plan.

- Generally, assumptions are more conservative in MEPP's because
  - defined benefits with a defined contribution
  - benefits can be reduced, but no one wants this
  - negotiating an increase in contributions may be difficult or impossible to do
- The following assumptions would need to be reviewed
  - Retirement
    - Hourly plan currently assumes a single retirement age, which may not be appropriate for MEPP
  - Mortality
    - 1983 mortality currently being used, more up to date would likely be used since MEPP's focus on long-term assumptions
  - Termination of employment
    - To promote generational equity, MEPP termination benefits tend to be more generous so withdrawal scales would be different
  - Administrative expenses currently paid by NOC but would be paid in MEPP
  - Normal form of pension - % married assumptions and spousal age difference

Solution 1 (Continued)

- Inflation
  - MEPP's often provide inflation protection on ad hoc basis whereas Hourly plan has some contractual protection so this assumption would change
- Asset valuation method
  - Smoothing of assets is almost universal in MEPP's whereas NOC Hourly values at full market

c) Explain how the factors that influence investment policy would likely differ between the proposed plan and the Hourly Plan

- MEPP's usually have more conservative asset allocation
- Factors that influence investment policy
  - Plans funding level – NOC has a funding deficiency. Depends on funded status of proposed plan.
  - Plan sponsor's risk tolerance
    - Proposed plan would have lower risk tolerance since no longer has NOC to sponsor funding deficiencies
  - Active/inactive liability distribution
    - Plan demographics will drive liquidity and cash flow requirements
  - Definition of risk
    - NOC would have been most concerned with accounting expense risk as opposed to MEPP who is most concerned with funded ratio risk
  - Objectives for the funding contribution and volatility
    - NOC might have been less concerned about cash contributions whereas a MEPP would be bound by collective agreement and would be very concerned about stability of contributions.

Solution 2

There is a decrease in the limit of periodic pensions from $3000 to $2000 per annum per year of service.

- tax savings initiative by government

Hourly Pension Plan

- there is no impact to the employers of the hourly pension plan, the annual pension for member retiring on and after January 1, 2006 is $80 \times 12 = 960$, well below the reduced limit.

DC Plan – no impact on funding or accounting

Salaried Pension Plan

- This reduction will cause a reduction in the liabilities and the normal cost of the salaried pension plan.
- The cash requirement, (asset mix) will reduce accordingly.
- This will only impact those employees with final average earnings of $100,000 or more.
- The employees may face more risk in the security of their benefits (defaults of sponsor) as the benefits in excess of the $2000 limit will be paid by the unfunded SRP.

Will the difference be made up in the SRP or not
There could be a valuation issue

- As the liabilities decrease the annual tax deductible contributions from NOC will decrease
- From the accounting perspective this will cause a negative prior service cost. The change to $2000 per year of service will reduce the accrued liability for those members affected. This impact will be absorbed by the prior service cost as a negative PSC.
- Going forward the expense for the salaried plan will be reduced as:
  service cost reduced
  PSC amortization will be reduced
  Interest cost will reduce (as ABO will be lower)

- From a design perspective, since the SRP is designed as a top-up plan to the salaried plan there shouldn't be any concerns from NOC on redesigning their salaried plan, as any members affected will receive any benefit lost from the SRP.

SRP

The decrease in the annual pension limit will shift some liabilities from the salaried plan to the SRP.

- From an accounting perspective this increase in liabilities will cause an increase in the prior service cost for the members covered by the SRP at the time the change in limit is announced. This PSC will be amortized by the EARSL of the SRP active population.

Solution 2 (Continued)

- The increase in liabilities for the new members joining will cause the ABO to increase without increasing the PSC, these new members will just increase the liabilities and the service cost.
- the expense will increase because:
  - higher SC
  - higher IC (interest on ABO and SC)
  - higher amortization of PSC

Since the SRP is unfunded, NOC has to contemplate the need to put more cash aside as new retirement from the SRP will receive higher pension amounts.

As more employees will receive benefits from the SRP (and these benefits will be higher), NOC many want to consider to have a funded arrangement. This will bring security to their high paid employers that will receive benefits from the SRP (most likely executives). Options to consider are:

Retirement Compensation Arrangement (RCA)

- Contributions and investment income as taxable
- Benefits are secured from credits

Secure Trusts – double taxation

- Contributions and investment income are taxable
- Benefits are secured
- ER can deduct contributions
- Surplus can't revert to employer

RABBI Trust

- No double taxation
- Investment income is taxable
- Benefits are not secured from creditors
- ER can deduct payments when they are paid to employee
- Contributions are investable

LETTER of CREDIT

- Annual expenditure
- Works like an insurance premium
- Bank serves as guarantor
- Not so secure, if company is in risk default, bank will not provide payment
- Premium is a function of risk.

Solution 3

a) When designing a pension plan, objectives fall under categories:

- Human resources
- Finance
- Employee
- Public policy

Human resources objectives:

- Workforce management tool
  - Attract and retain employees
  - Facilitate orderly retirement
  - Workforce characteristics define type of plan
  - Relative weights between compensation and deferred compensation depend on industry and dynamics of the workforce

- Allows flexibility to adapt to changing labor market
  - Change in demographics

- Maximize the perceived value of plan by employees
  - Communication to employees to facilitate appreciation
  - Ease of understanding of the retirement program
  - Investment and retirement adequacy education

Finance objectives

- Sustainable costs on long term through industry and economic cycles
- Predictable and stable cost
- Minimal administrative burden
- Accounting implications

Employee objectives

- Protection against retirement income risks
  - Inflation
  - Investment performance
  - Replacement ratio
  - Longevity
  - Sponsor credit risk
  - Interest rate
  - Early retirement
  - Job tenure
  - Implicit contract
  - Demographic
  - Political

Solution 3 (Continued)

- Want competitive package
- Want acceptable post-retirement standard of living
- Ease of understanding of retirement program
- Maximize effectiveness of saving for retirement (tax efficiencies)

Public policy

- Comply with regulation
- Non-discrimination tests

b) Alternatives in setting up contribution formulas are:

- Automatic flat contribution (fixed dollar amount or fixed percentage of pay)
- Contributions based on age, service or combination
- Contribution based on financial variable tied to sponsor's performance (e.g. profit)
- Different forms of matching of employee contributions
- Mirror DB accrual (e.g. target plans)

Considerations

- Consider competitive positioning
  - With respect to industry and local competitors
  - Helps to attract and retain employees
  - Compare to competitors' plans, costs, contribution levels and total compensation
- Comparison of new DC plan to existing DB plan
  - Wit respect to value and accrual pattern

- Plans related to profits
  - Results in flexibility to employer
  - Motivates employees' performance

- Influence employee participation
  - With higher matching contributions
  - Automatic enrollment

Solution 3 **(continued)**

- Formula related to service can influence retirement behavior
- Mimic DB accrual
    - Assist with retention
- Formula should produce meaningful benefit upon termination or retirement (adequacy)
- Integration with other plans at NOC
- Turnover
    - New plan should help with current turnover problems at NOC

Solution 4

a) Integration Methods

- Standard Coordination of Benefits
  - NOC benefit = Minimum of: Covered Cost – Government Benefit or (Cost Coverage %) (Covered Cost)

- Advantages:
  - Easy to understand
  - Cheaper than no integration

- Disadvantages:
  - Still exposed to subtotal inflation risks (medical trend)

Exclusion Method
  - NOC Benefit = (Cost Coverage %) [Covered Cost – Government Benefit]

- Advantages
  - Saves more than Standard Coordination of Benefits

- Disadvantages
  - Still exposed to medical inflation

"Carve – out"
  - NOC Benefit = (Covered Cost %) (Covered Cost) – Government Benefit

- Advantages
  - Cheaper than even exclusion

- Disadvantages
  - Cost effected by order of claims (can get around by using debit system)

Supplemental Plans ("Medi-gap" policies)
  - NOC would pay non covered government expenses (they choose which)

    - Rx drugs
    - Co-Pays
    - Deductibles
    - Premiums? (if applicable)

- Advantages
  - Can be as cheap or expensive as NOC wants

Solution 4 (Continued)

- Disadvantages
  - If covered Rx for example, still exposed to medical trend. (But has been low for NOC)

Offer Pre-65 coverage only

- Advantages
  - Much lower costs
  - No exposure to Post-65 trend
  - No administrative headaches of using integration methods like carve-out

- Disadvantages
  - Could result in later, less orderly retirements
  - Could decrease employee morale

"Contract Out" (like in U.S with Medicare Part-D)

- Advantages
  - If NOC's population is cheaper than population of Vosne then will be a saving

- Disadvantages
  - Exposed to medical trend
  - Needs attestation of actuary and paper work
  - Uncertain if Vosne would allow

b) First of all I would recommend that NOC institute the same method (or more generous) to the Hourly plan to avoid equity and morale issues. (Same method is performed)

Recommend "Contracting Out" if allowed by Vosne

- Would likely save NOC money
- Trend has been very low recently $\left(\frac{8800}{8125}\right)^{(1/3)} \Rightarrow 2.7\%$ average (if expected to increase then may want to re-consider)

Solution 4 (continued)

If not available then recommend using standard coordination of benefits for most benefits at a minimum and carve-out for hospital stays.

- Would save cost
- Likely to not meet much employee resistance
- Administration would be more expensive, but should be offset by savings
- Will keep working as a retention tool
- Can still be used for HR objectives
    - encouraging early retirements (or at least orderly)
    - attracting talent
    - retaining employees

Solution 5

(a)

Advantages and Disadvantages of Providing Supplemental Death Benefits through a Pension Plan

Advantages:

- Not subject to state law that limits the amount of coverage
- No state premium tax
- No imputed tax; employer contributions to a trust are not taxable to the employees
- May lower cost if receive a higher return than the insurance company
- Can be coordinated with the pension benefit more easily and with greater precision

Disadvantages:

- Must be incidental
- Payments from a trust are subject to taxes
- Large death benefits payable from a pension plan are subject to special estate taxes
- Death benefits that are significantly larger than an employee's accrued liabilities can cause fluctuations in cost

Plan sponsor must provide a qualified pre retirement survivor annuity and if any, refund the employee contributions.

(b)

Provides equity across employees – those who die w/o receiving retirement benefits have something paid to spouse. Since employee maybe was giving up some wage for deferred retirement benefit, it is fair to give his estate something in exchange for that deferral.

Other rationale: paternal company that wants to take care of employees and families; competition is doing it and you need to attract retain employees; tax advantages to er/ee; ease of administration vs. a big insurance plan with multiple policies, etc.

Employee communication / HR issues

- ees won't like benefit taken away
- need to have good communication about reasoning + effects
- replace with life insurance benefit that is at least comparable to what is taken away
- NOC doesn't seem to be under any government requirement preventing cutback, so seems legal. Just want to buffer against angry/upset employees.

Solution 5 (continued)

Administration
- Life insurance contracts will require more immediate info on participants – spouse info etc. rather than pension plan coverage
- Gather pertinent info for the insurer
- How does admin cost of the insurance policy compare with that of keeping in pension plan

Amendment
- Will incur actuarial fees, legal fees, admin fees
- Need to file plan amendment (legal fees)

Competition
- Consider competitor's benefits
- How do NOC's compare?
- How will the change impact HR's ability to attract and retain personnel

Taxation
- Will ees be taxed on these insurance premiums?

(c)

Removal of death benefit will decrease liability and SC

Check with NOC's auditor to see if settlement or curtailment rules apply: does not seem curtailment since accrual and service continue in pension plan. Does not seem to be settlement as liability and risk still in pension plan for the employees.

Reduce expense due to lower interest cost, service cost and negative past service cost amortization

No more death benefit therefore does not need as much liquidity

Lower contributions due to lower NC

Should reflect an amendment in funding and expense valuation. Negative PSC layer to establish under FAS87. First offset any positive PSC layers.

Will the plan be left in surplus position? Can surplus be reverted to NOC to help buy the insurance contract? Assuming similar rules as US/Canada, they could not do this. Big excise tax if revert surplus to NOC.

Solution 6

(a) We first roll-forward ABO + FVA to 1/1/07 (using simple interest)

$$\text{ABO } 1/1/07\ 5.5\% = 903,903\times(1.055)+50,021(1.055)-20,500\left(1+\frac{1}{2}0.055\right)$$
$$= 947,390$$

assuming contribution amount in 2006 was made June 30, 2006.

The ABO at 5% can be obtained by using the duration.
For a 1% decline in interest rate the ABO will increase by 12%.
For a 0.5% decrease (from 5.5% to 5.0%), the ABO will increase by 6%,
that is $\text{ABO } 1/1/07\ 5\% = 985,326(1.06) = 1,044,446$

At 1/1/06 there is no unrecognized Prior Service Cost, so UPSC 1/1/07 = 0
The Accrued Benefit Liability can also be rolled-forward

$$\text{ABL } 1/1/07 = 91,826+36,566-41,865 = 86,707$$
so the balance sheet looks like

ABO	(1,044,446)
FVA	947,390
Funded Status	(97,056)
UN(G)/L	10,349
ABA/(L)	(86,707)

Now the 2007 expense. The service cost can be rolled-forward from the 1/1/06 service cost at 5.5% as
$\text{SC } 1/1/07\ 5.5\% = 50,021\times(1.035) = 51,772$

Using the SC duration, we can infer:
$\text{SC } 1/1/07\ 5\% = 51,772\times(1.10) = 56,949$

Interest cost is

$$\text{IC} = (1,044,446+56,949)\times 0.05-22,000\times\frac{1}{2}0.05 = 54,520$$

expected ROA (assuming return assumption remains 7.5%)

$$= 947,390\times 0.075+43,000\times 0.075/2-22,000\times\frac{1}{2}0.075 = 71,842$$

Solution 6 (continued)

Finally, Amortization of G/L is:
Corridor: 10% Max (ABO, FVA) = $0.1 \times 1{,}044{,}446 = 104{,}445$

Since the unrecognized is within corridor, there is no amortization.

Therefore, estimated pension expense for 2007 is

Expense = SC + IC – EROA + Amort (G)/L
= 56,949 + 54,520 – 71,842 + 0
= 39,627

(b) Factors that may cause expense to differ from budget & impact

- Expected return on asset (assumption) if it decreases, EROA will decrease and Expense will increase
- Actual return on assets
- changes in actuarial assumptions @1/1/07
- discount rate at 1/1/07 may not be 5.00%
  - will impact service cost, interest cost and potentially amortization of gains/losses
- estimated employer contributions this affects EROA, so a larger contribution will slightly decrease the budgeted expense
- estimated benefit payments
  Affects items: IC and EROA and a difference will cause a very slight difference on expense (proportional to the difference between discount rate and rate of return on assets)
- No other gains + losses
  Corridor is large under these assumptions, but it may change under different assumptions, so there may be an amortization.
- No plan changes
  If there is a plan change, ABO will change + there will be a PSC basis and thus an amortization
- Other events
  - settlement (if payout portion of member population)
  - Curtailment (if there is a significant reduction in future working lifetime)

These events would cause a one-time impact on the pension expense (either positive or negative).

Solution 7

(a) One of the fiduciary duties is diversification:

- Trustee is required to act in a way a prudent professional investor would act
  - For pension trusts, this duty is higher than it is with ordinary trusts
- Investor must have professional training
  - Trustee may delegate to a competent professional if he does not have such training
- Need to invest the assets in such a way as to minimize the risk of large losses
  - Unless under the circumstances it is not prudent to do so
- Duty to diversify applies to investments not in isolation, but in the context of the entire trust
- Trustee is under the obligation to balance risk and expected return in a way that is consistent with the needs of the trust and beneficiaries
- There is no inherently imprudent investment
- Higher expenses or commissions should result in higher returns or decreased risk
- Prudence in an investment is determined at the time of investment, not in hindsight
  - Diversification should be done with both prudence and care

(b) The asset mix proposed by the CFO does not appear to have been as carefully selected as that of the current mix:

- 10% cash allocation is too high an allocation considering retiree liability; NOC's salaried plan
- There seems to be little reason to invest in municipal bonds in the pension trust; there is no tax advantage gained
- Venture capital is very risky; it is volatile and has high returns; it should be considered within context of whole portfolio; 20% seems a little high
- Need to consider expected return/risk as it correlates with rest of portfolio
- TIPS/Real Estate may help with inflation hedge
- Should perform ALM study to model liability and asset performance under a variety of economic scenarios

(c)

- Using the information provided in the question, you should calculate the expected return for both the current and proposed portfolios (Current portfolio expected return = 10.4% and Proposed portfolio expected return = 13.3%)
- Treynor formula = $\left(R_p - Rf\right)/$ beta p
  - Treynor formula calculation current portfolio
    $= \left(10.4\% - 4.0\%\right)/1.0 = 6.35\%$
  - Treynor formula calculation proposed portfolio
    $= \left(13.3\% - 4.0\%\right)/1.5 = 6.17\%$

Solution 7 (Continued)

- Sharpe formula = $\left(R_p - Rf\right)/$ stand deviation p
  - Sharpe formula calculation current portfolio
    = $(10.4\% - 4.0\%)/\sqrt{(15\%)} = 16.4\%$
  - Sharpe formula calculation proposed portfolio
    = $(13.3\% - 4.0\%)/\sqrt{(20\%)} = 20.68\%$
- Treynor formula calculates return per unit of systematic risk
- Treynor assumes a perfectly diversified portfolio
- Sharpe formula calculates return per unit of total risk
- Both formulas assume a linear relationship between risk and return
- Treynor measure would choose current portfolio since that calculation is higher
- Sharpe measure would choose proposed portfolio since that calculation is higher
- Since they conflict and Sharpe measure considers the effects of diversification, would recommend the proposed portfolio

Solution 8

Traditional

- Consistently uses as a valuation interest rate, the rate earned on AVA
- Level-out contributions over time
- Expected future plan costs
- No probability for non payment benefits
- Blended rates: current market rate, short-intermediate rates, long term reversionary mean
- Allows for equity risk premium
- Allows for margin for adverse deviation

When to use traditional

- Benefits allow for adhoc pension increases
- EE/ER both contribute to plan
- New entrants allowed
- Tolerance for some volatility in contributions
- Company needs equity risk premium here and cannot get exposure elsewhere to risky assets

Funding for NOC

- Can use smoothed (market-related) asset values

Financial

- Consistent with rate on bond portfolio
- Want liabilities covered at all points in time not just to level-out contributions
- Allow for probability that benefits not paid (credit risk)
  - probability of plan term
  - will it be unfunded
  - can company make up shortfall
- Uses current market ratio
  - no equity risk premium
  - no margin for adverse deviation

When to use Financial

- Benefit increases adhoc not allowed
- ER is the only one making contributions
- No new entrants allowed
- No tolerance for contribution volatility
- Company can afford a higher pension
- Costs and seeks an equity risk premium elsewhere

Solution 8 (continued)

Accounting for NOC

- Market asset value used
- Pension liabilities have characteristics similar to bonds with similar cash flow timing

Financial is used for accounting valuations and disclosure for the financial statements. Use MVA and current market assumptions. Accounting assumptions are best estimate by management and reflect the return expected on high quality corporate bonds based on duration of the plan or on the lump settlement rate.

Traditional used for ongoing & funding of plan. It's a long term view and you want to minimize long term costs of the plan.

Difference between the two results from the traditional having the equity risk premium RRP & MAD – margin for adverse deviation - while financial has the credit risk. They need to determine the actuary's estimates of theses values & how they are different from the market. How they actually selected these estimates is also important.

More transparency is needed with the traditional method:

- Policies need to be approved by the trustee
- Aggregate assumptions need to be developed, full disclosure needed, discipline used to select your assumptions
- Selection of best & ultimate rates changes need to be watched from valuation to valuation policy & approval on a margin for advance duration
- The ERP should never be 0 in the long term & the market should not be used to predict the future

Financial economics is not typically used in the actuarial profession but should be because it's been proven to work.
Violations include:

- Participants bear risk they can't reduce or eliminate Public plan transfers into next generation
- Underfunding still exists in steel industry
- Mispriced pensions lead to compensation issues
- Actuarial assumptions bias investment decisions
- Accounting assumptions result in volatility and unearned premium

Solution 8 (continued)

Other violations

- Actuarial & accounting bias investment decisions
- Smoothing conceals risk
- Hypothetical gains conceal economic volatility
- Underpriced pensions affect compensation decisions
- Transfers of risk to other generations
- Extension of amortization periods

What financial economics does

- $1 Bonds = $1 Equity, actuarial only considers expected value, while this considers risk
- All assets & liability should be at fair value
- Risk taken & rewards should be by individual not ER
- Assets should be available to all
- Liabilities should be valued in a deep & liquid mark

Don't want companies like NOC to take an asset focus. Want ALM & match the Assets & liabilities & reduce volatility. Depends on importance of obligation to pension plan relative to all other obligations of company. This is why they tend to invest with an equity focus. Financial economics would change the valuation of NOC as follows:

- Value assets at MV & Liabilities using UC
- Interest is based on credit quality
- Planned colas are recognized
- Gains/Losses amortized over shorter period
- EROA is actual return on assets

Financial economics allows actuaries to face challenges and be in line with other companies. Should employ stochastic practices & allow new entrants, debt is not a good model because:

- Dynamic is wrong
- Duration can't be found in market
- Plan costs are hard to predict
- Pensions are debt so why not all costs use this classification
- No market
- Sponsors care about cost/not liabilities
- Funding is key to reducing risk

Solution 8 (continued)

	Traditional	ALM
Funding	regulated/negotiated rates	ties to investment policy min PV risk aggregate costs
Equity	depends on risk tolerance to trustee	depends on liabilities & funded status
Ben. policy	maximization per unit of cost on deterministic basis	max PV risk adj. cost on fully integrated basis
Bond duration	Short-intermediate high return per unit of volatility	low cost per unit of volatility
Inv policy	max ret per unit volatility	min cost per unit volatility

Assets at NOC have Asset focus & should be changed to more ALM focus to minimize volatility & reduce expense.

Solution 9

Code of conduct

- Professional Integrity
  - Act honestly & professionally

- Standards of practice
  - Must follow applicable standards of practice
- Control of work product – take reasonable steps to ensure services are not used to mislead
- Need to check data (per ASOP or CSOP) for consistency, reasonableness, appropriateness for use.
- Communicate to the client that the results are wrong and new valuations are required based on the revised data
- Evaluate the reasonableness of the assumption in light of the revised data

1) Increase in active counts. This will increase PBO and service cost. Actually it appears this increase is due mostly to new hires. If this is the case then PBO/ABO will not change (maybe slightly for the partial year of benefit accrued). SC will definitely go up.

2) Terminated nonvested counts went up. This would cause a decrease in PBO. It would also have an impact on your (gain/loss) reconciliation. Term nonvesteds will be gains.

3) TV lump sum cashouts increased. This will decrease PBO.

4) Retirements decreased. This will increase your retirement gain. This plan has a highly subsidized early retirement reduction, therefore it's more costly when employees retire.

5) Death with beneficiary
   - More deaths will increase mortality gain. Small impact on liability because beneficiary receives J&S benefit

6) Average age & average service is lower.
   - Should point to decrease in liability. Longer discount period (age). Less benefit service, smaller accrued benefit.

7) Average plan earnings increased. Does not mean much for hourly plan. Won't effect liabilities.

8) Average age of retirees increased. Decrease in liability due to fewer remaining payments until death.

9) Death with no beneficiary, increased, again this would decrease liability.

Solution 9 (Continued)

10) Some items have little or no impact on funding but would affect accounting (e.g. avg. future working lifetime). This effects (G)/L amortization for pension expense purpose.

11) Consider changing demographic assumptions including the turnover table, the retirement rate assumption, and the mortality assumption.

Overall, seems like probably a smaller liability & normal cost which wouldn't mean the required contribution will decrease.