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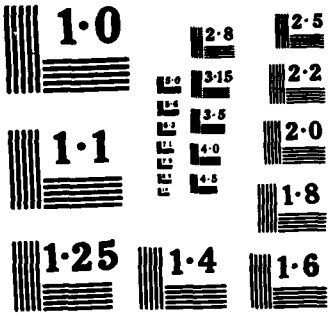

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DISCOUNTED CASH FLOW MODEL FOR THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM

Report RE301-4

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Myron G. Myers
Paul R. McClenon
Michael J. Konvalinka
Geneese Gottschalk

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LOGISTICS MANAGEMENT INSTITUTE
6400 Goldsboro Road
Bethesda, Maryland 20817-5886

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1. INTRODUCTION

PURPOSE

The Industrial Modernization Incentives Program (IMIP) has been developed to overcome disincentives for investment inherent in Department of Defense (DoD) contract pricing policies. Without IMIP, Defense contractors are reluctant to acquire cost-reducing, productivity-enhancing equipment, because as costs are reduced, negotiated profits on future contracts are also reduced. Within the past ten years, DoD policies have been changed to make facilities investments more attractive, but little has been done to encourage contractors to select those investments yielding the highest productivity gains. With IMIP, contractors can be encouraged to invest by being allowed to retain, as an incentive, a share of the cost savings derived from their investments. The contractor's share is determined so as to ensure an adequate return on investment. IMIP policy also requires that contract price reductions remain after the incentive payment so that DoD also benefits from the contractor's acquisition of modern facilities.

To reach an equitable and effective sharing agreement, DoD and contractors must be able to quantify the savings expected from an investment, determine the contractor's expected financial return from the investment (with and without proposed incentives), and determine how much benefit remains for DoD. This document describes such a procedure – discounted cash flow (DCF) analysis. A "spreadsheet" financial analysis personal computer program has been developed for easy application of the procedure by DoD and its contractors. Originally developed and documented early in 1984, the DCF Model (LMI DCFM Version 1.00) has been circulated and tested within DoD and by industry. This document describes the updated version of the original model, now available as LMI DCFM Version 2.00.

DISCOUNTED CASH FLOW ANALYSIS

DCF analysis measures the financial effects of an investment on the basis of associated cash flows. The DCF Model analyzes the effects of an investment from the perspectives of three parties: the contractor, DoD, and (if tax effects are considered) the Government.

Contractor Perspective

The model computes the contractor's annual before- and after-tax cash flows arising from the investment. It then compares the stream of cash outflows (principally the cost of the facilities investment) with after-tax cash inflows and computes the contractor's return on investment. Contractor return is measured by the internal rate of return (IRR). Specifically, the IRR is the discount rate that would make the present value of cash inflows equal to the present value of cash outflows. The IRR provides a basis for comparison with other investment alternatives and the contractor's investment "hurdle rate."

Contractor cash inflows are payments from the Government not immediately offset by cash payments from the contractor to third parties such as vendors or employees. Contractor cash outflows are payments not immediately offset by equal, opposite cash receipts from the Government. Consequently, in Government contracting, the elements of cash flow arising from new contractor investment are:

Inflows:

- Annual imputed cost of money based on the remaining book value of the proposed facilities investment, as provided by Cost Accounting Standard (CAS) 414 and Federal Acquisition Regulation (FAR) 31.205-10(a).

- Annual depreciation on the proposed investment (because depreciation is an allowable contract cost under CAS 409 and FAR 31.205-11).

- Net change in profit (increase or decrease) -- representing the effect of the proposed investment on the profit component of price; consisting of profit on depreciation, profit from the weighted guidelines facilities capital component, and any reduced profit due to reduced contractor costs (the DoD benefit analysis (see Chapter 3) calculates the combined effect of all of these elements on profit).

- Any productivity savings reward (PSR) -- the incentive offered through the IMIP to result in an adequate contractor IRR on investment.

Outflows:

- Contractor facilities investment expenditures.
- Contractor income taxes resulting from higher taxable income -- reduced by any additional investment tax credit for capital investments, based on current Internal Revenue Service (IRS) guidelines.

It should be noted that other contractor-incurred costs and payments from DoD are assumed to be coincident, or so nearly coincident that they can be ignored. Employee wages and salaries, for example, are not considered, because they are paid by DoD within a relatively short time.

The model takes into account only additional contractor cash flows attributable to the proposed investment in new facilities. It measures additional CAS 414 payment, depreciation, profit effect, and the PSR associated with the investment, as well as the additional outflows for the facilities and any increase or decrease in income taxes. The yearly values of inflows and outflows define the contractor's after-tax cash flow profile -- typically negative in the early years when investment occurs, subsequently positive, and then negative again when PSR payments end and reduced profit is the main factor. An IRR is computed from the annual after-tax cash flow profile both with and without a PSR incentive. A PSR can be offered if the contractor would otherwise earn an inadequate IRR.

DoD and Government Perspectives

The DCF Model also computes the anticipated costs and benefits of the proposed investment to DoD and to the Government overall. Benefits are computed year by year on the basis of the investment's effect on the contract price paid by DoD. A format has been prepared to assist in determining contract price effects (see Chapter 3). For a particular investment, additional costs to DoD and Government are also included to determine net benefits. These costs are the PSR that may be negotiated, any DoD funding for early phases of the IMIP, and the tax effects, from the Government's perspective. The relationship of contract price reductions (called savings available to DoD), DoD costs, and tax effects on the Government is displayed below.

The net DoD benefit is as follows:

Estimated Savings Available to DoD
- Productivity Savings Reward
- DoD IMIP Funding
= Net DoD Benefit (Cost, if negative).

The model also computes a benefit profile that adjusts the DoD profile for the effects of tax recoupment by the Treasury. Thus, the net Government benefit is as follows:

Net DoD Benefit
+ Additional Federal Taxes Paid by the Contractor
- Additional Investment Tax Credit Earned
= Net Government Benefit (Cost, if negative).

These amounts are displayed on a year-by-year basis and are evaluated in terms of payback periods.

NEGOTIATING AN INCENTIVE WITH THE DCF MODEL

It is contemplated that the contractor and DoD will arrive at a PSR on the basis of a mutually agreed-upon IRR. To arrive at the amount and timing of the PSR payment, several iterations of the model with alternative PSR streams will usually be necessary.

It is important to realize that no unique PSR stream is associated with an agreed-upon target IRR. The DCF Model can be used to test a number of alternative sharing arrangements that produce the agreed-upon target IRR. For example, the contractor can be offered all of the annual savings initially available. The model can be run with 100 percent of available savings as the PSR in the first year and nothing thereafter. The model will show the resultant contractor IRR. Additional years of PSR can be introduced as required if the contractor IRR is still inadequate. At the other extreme, DoD can retain all of the savings in the early years, with PSR payments commencing later in the program's life. Thus the PSR eventually negotiated can be suited to characteristics of the situation and constraints faced by both contracting parties.

CONTENTS

In the remainder of this document, Chapter 2 describes the report produced by the model. Chapter 3 discusses the analysis necessary to determine the potential benefits available from a cost-reducing investment. Three appendices are also provided. Appendix A describes the model's

automated benefit analysis. Appendix B provides specific hardware and software operating instructions. For the convenience of users of the earlier version, Appendix C summarizes the differences between Version 1.00 and Version 2.00.

2. DISCOUNTED CASH FLOW MODEL

GENERAL DESCRIPTION

This chapter describes the basic report supplied by the DCF Model. Its format is illustrated in Table 2-1. The model has been prepared for use with a computerized spreadsheet financial program,

TABLE 2-1. DISCOUNTED CASH FLOW MODEL

DISCOUNTED CASH FLOW MODEL (Version 2.00, with benefit analysis)
(Hold down the [Alt] key and press M to get model options)

		1986	1987	1988	1989
Year:		1	2	3	4
SECTION I. CORE DATA					
1 Contractor Investment		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
2 Contractor Expenses		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
3 DoD/Government Funding		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
4 Savings Available to DoD		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
SECTION II. INCREMENTAL CASH FLOWS					
5 Productivity Savings Reward		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
6 Cost of Money (CAS 414)	xx.xx%	0.0	0.0	0.0	0.0
7 CAS 409 Depreciation		0.0	0.0	0.0	0.0
8 Profit Effect		(0.0)	(0.0)	(0.0)	(0.0)
9 Subtotal: DoD Cash Flows to Contractor		0.0	0.0	0.0	0.0
10 Salvage Value		0.0	0.0	0.0	0.0
11 Contractor Before-Tax Cash Flow		0.0	0.0	0.0	0.0
SECTION III. TAX CALCULATIONS					
12 ACRS Depreciation		0.0	0.0	0.0	0.0
13 Contractor Taxable Income		0.0	0.0	0.0	0.0
14 Contractor Income Tax	46%	0.0	0.0	0.0	0.0
15 Investment Tax Credit	yy%	0.0	0.0	0.0	0.0
16 Contractor After-Tax Cash Flow		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
SECTION IV. SUMMARY					
17 DoD Program Benefit (Without Incentive)		0.0	0.0	0.0	0.0
Cumulative Total	0	0.0	0.0	0.0	0.0
18 DoD Program Benefit (With Incentive)		0.0	0.0	0.0	0.0
Cumulative Total	0	0.0	0.0	0.0	0.0
19 DoD Payback Period	0.0 years				
20 Government Benefit		0.0	0.0	0.0	0.0
Cumulative Total		0.0	0.0	0.0	0.0
21 Government Payback Period	0.0 years				
22 Contractor Internal Rate of Return		(Condition)			
Without Incentive	0.0%	(1)			
With Incentive	0.0%	(1)			
(IRR Conditions: 1-Unique positive IRR; 2-No positive IRR; 3-Infinite IRR; 4-Possible multiple IRRs)					
23 Contractor Payback Period	0.0 years				

Lotus 1-2-3,[1] and it operates on an IBM or IBM-compatible personal computer. Consequently, recalculation of the report with varying assumptions, particularly different PSR schedules, is quite easy and should aid the negotiation process. The DCF Model description that follows presumes that two data series are known and available for input to the DCF Model -- profit effect and savings available to DoD. These data series are derived from the benefit analysis described in Chapter 3.

CORE DATA (LINES 1-4)

1. Contractor Investment. This is the time-phased forecast of expenditures for facilities to be acquired. Included are any costs normally capitalized by the contractor (e.g., installation costs). It is possible that the proposed facilities investment will be employed on both commercial and Government contract work, and on DoD programs other than those participating in the IMIP incentive. When such multiple use of these facilities is anticipated, the investment value entered in the model should correspond to the share allocated to DoD work and not to the entire investment value. The DoD-allocated share of investment should be based on the allocation method normally used to assign CAS 409 depreciation costs to DoD contracts. Note that all DoD work, not just programs participating in the IMIP incentive, should be the basis for allocating the investment and calculating savings, since nonparticipating DoD programs also benefit from the investment and bear their share of investment-related costs such as depreciation and imputed cost of money.

Investment-associated costs reimbursed directly by the Government, such as IMIP Phase I and II expenses, are excluded here and reported on Line 3 (DoD/Government Funding). Investment-related costs reimbursed by the Government in overhead are also excluded from the DCF Model. They are included in the DoD benefit analysis, where they are recognized as part of overhead; they effectively "wash out" for the contractor and are considered only in the computation of savings available to DoD.

Contractor investment expenditures are entered directly into the model's input section (see Chapter 3 and Appendix B) in the columns for the years when they are expected to be incurred.

[1] Lotus 1-2-3 is a trademark of Lotus Development Corporation.

Year 1 is thus defined as the first year in which a contractor's capital expenditure occurs. Such expenditures may occur well before an asset is placed in service. The DCF Model allows for timing differences between expenditures and initial depreciation recovery (capitalization) by an input for the year the asset is first placed in service. Placing an asset in service in Year 3, for example, implies that expenditures began in Year 1 of the analysis, while capitalization takes place in Year 3.

Additional investments for facilities placed in service after the initial investment is first capitalized can also be entered. Investments made in years after the initial investment is first capitalized are immediately capitalized in the year the investment is entered in the model.

2. Contractor Expenses. This line is for expenses associated with the above investment process that are incurred by the contractor and not reflected in Government contract pricing. IMIP Phase I and II expenses are examples, provided they are not reimbursed directly or indirectly by the Government. Another example is engineering effort expended in conjunction with the investment that is not capitalized in the investment cost or otherwise reimbursed by the Government. If such engineering effort is directly reimbursed by DoD, it is entered in the DoD/Government funding line; see below. If reimbursed indirectly, it appears in the DoD benefit analysis as part of overhead. Contractor expenses are entered in the DCF Model for the year incurred. Generally, they are prior to or coincident with the year in which the asset is placed in service and depreciation recovery begins.

This line may also be used, with negative values, to report any taxable net cash inflow to be received by the contractor upon disposition of existing facilities that are to be replaced.

3. DoD/Government Funding. DoD/Government funding is the total DoD and other Government cost of implementing the IMIP -- funded directly. Investment-related costs reimbursed indirectly are included in the DoD benefit analysis as part of overhead . (See Chapter 3.)

Line 3 costs are entered in the column for the year they were or are expected to be incurred. In all likelihood, these costs represent early Phase I and II effort and thus occur before any contractor expenditures for facilities acquisitions. Since Year 1 is defined as the initial year when facilities-related costs occur, Line 3 costs already may have occurred before Year 1. Direct DoD/Government funding affects only DoD/Government benefits and costs and not contractor cash

flow or return. Consequently, Line 3 costs incurred before Year 1 can be summed and entered in Year 1 of the analysis.

4. Savings Available to DoD. This line is the time-phased summary of the net reduction in contract price expected as a result of the productivity-enhancing investment. This summary includes recognition of all changes in contract cost (investment-related cost reduction, increased depreciation, and increased imputed cost of money) and the related changes in profit objective. The savings available to DoD is the result of an analysis of the type described in Chapter 3. (The model's computational technique is detailed in Appendix A.)

The total savings available to DoD is the basis for the IMIP deal. The PSR (Line 5, below) is the contractor's share, and the remainder is for DoD's benefit.

INCREMENTAL CASH FLOWS (LINES 5-11)

This section and the one that follows comprise the contractor incremental cash flow analysis: Lines 5-11 give the before-tax cash flow, and Lines 12-16 are used to calculate the after-tax cash flow. The after-tax cash flow stream is then used to determine the contractor's IRR on the facilities investment.

5. Productivity Savings Reward (PSR). This is the year-by-year amount of incentive payment to the contractor to encourage the proposed facilities investments under the IMIP concept. The PSR is a portion of the total savings available to DoD. If contracts priced before the IMIP deal will benefit from the investment, the benefits to the contractor may be included as if they were part of the PSR. Similarly, if the facilities are to be used for both commercial and Government work, the Government may choose to include the measurable cost savings on commercial work as if it were part of the PSR. Typically, the parties will modify the amount and timing of the PSR several times in their negotiation of an equitable sharing of the total savings available. The DCF Model furnishes an evaluation in terms of IRR for each particular PSR schedule.

6. Cost of Money (CAS 414). CAS 414 "Imputed Facilities Capital Cost of Money" is included in contract price as an allowable cost (see FAR 31.205-10). The payment is an element of contractor cash inflow, since it is an imputed cost; for the contractor there is no corresponding cash

outflow. The CAS 414 payment is based on the remaining undepreciated balance (i.e., net book value) of the proposed facilities investment. For each year, the beginning and ending net book values are averaged to determine the applicable book value. This average book value is then multiplied by the "cost of money rate," supplied by the user as an input, to yield the total dollar payment for CAS 414. The model automatically performs the entire calculation.

7. CAS 409 Depreciation. Annual depreciation expense is an allowable cost on Government contracts under FAR 31.205-11 and is a source of cash inflow to the contractor. Depreciation is the delayed cash inflow that offsets the initial cash outflow incurred to acquire additional facilities. The annual amounts appearing on this line depend on the asset service life and the method of depreciation used. The amounts appearing are generated automatically by the program after selection of service life, the year capitalization begins, and depreciation method for the asset value assumed. The methods available and a description of the techniques used to generate annual CAS 409 depreciation are as follows:

Method 1. Straight Line: This method assumes an equal amount of depreciation in each year of the asset service life. The annual depreciation amount is given by the formula:

$$Annual\,Depreciation = \frac{Cost - Salvage\,Value}{Asset\,Service\,Life}$$

Cost is defined as the full asset acquisition cost, including all costs normally capitalized. It is reduced by the estimated salvage value for depreciation purposes, but only if the salvage value is 10 percent or more of the total asset acquisition cost.

Method 2. Sum-of-Years Digits: Annual depreciation is given by the formula:

$$Annual\,Depreciation = \frac{Number\,of\,Remaining\,Years\,Service\,Life\,x\,(Cost - Salvage\,Value)}{Sum-of-the-Years\,Digit\,Service\,Life}$$

The sum-of-the-years digits service life is computed by adding the digits of the number of years in the asset service life. For example, if the asset service life is five years, the digits 1 through 5 total 15 (1+2+3+4+5), and the first year's depreciation is 1/3 (5/15) of the total to be amortized. The depreciation basis is full asset acquisition cost less salvage value. As with Method 1, if salvage value

is less than 10 percent of acquisition cost, salvage value is treated as zero for purposes of depreciation calculation.

Method 3. Sum-of-Years Digits with Half-Year Convention: This method applies a half-year convention to the sum-of-years digits method. Under it, the annual depreciation amounts are computed exactly as in the sum-of-years digits described in Method 2; however, the amounts to be depreciated are shifted by one-half year. Thus, in the first year, one-half of the amount computed in Method 2 is allowed. In Year 2, the remaining depreciation from Year 1 and one-half the Method 2 depreciation amount for Year 2 are allowed. This one-half year shift continues until the end of the asset service life. One year after the asset service life ends, the remaining one-half of the Method 2 depreciation amount for the final year is taken.

Method 4. 150-Percent Declining Balance: The annual depreciation expense for this method is computed as follows:

$$Annual\ Depreciation = (1/Asset\ Service\ Life) \times 1.5 \times (Cost - Accumulated\ Depreciation)$$

Under this method, the cost is not reduced by the salvage value in the depreciation calculations; however, the asset is depreciated only down to its salvage value. As with the other methods, salvage value is ignored if it is less than 10 percent of the acquisition cost.

Method 5. 150-Percent Declining Balance with Switch-Over to Straight Line: This method uses the declining balance described in Method 4. However, a switch-over to straight-line depreciation (Method 1) is made at the point where the declining balance depreciation amount becomes less than that which would be allowed under the straight-line method. Again, depreciation is not allowed below the salvage value, and salvage value is ignored for values less than 10 percent of the acquisition cost.[2]

[2]These methods include the most likely patterns of allowable depreciation for contract cost purposes. Sometimes, however, a contractor's proposal may employ a different stream of depreciation charges (one reason might be a project that includes assets with different service lives). Under these circumstances, the user may supply directly to Line 7 the year-by-year depreciation amounts.

8. Profit Effect. These annual values represent the net change in profit objectives, after considering the reductions based on lowered "contractor effort" and the increases based on greater facilities capital employed. Determination of the profit effect is an important result of the benefit analysis described in Chapter 3. The model's automated technique for deriving this line is described in Appendix A. The profit effect, if not negative initially, will usually become negative over time as annual depreciation and undepreciated balances both decline and the full cost-saving effects of the investment are realized.

9. Subtotal: DoD Cash Flows to Contractor. This subtotal represents the changes in the before-tax cash flow to the contractor from DoD arising from the proposed facilities investment. Cash flow from DoD to the contractor is the sum of the PSR payment (Line 5), CAS 414 imputed facilities capital cost of money (Line 6), CAS 409 depreciation on additional facilities capital (Line 7), and the profit effect (positive or negative) given by Line 8. The DoD cash flows to the contractor represent the additional cash flow stream to the contractor arising from the investment and its effects on contract price. The program automatically calculates cash flow from DoD to the contractor.

10. Salvage Value. Salvage value represents an anticipated cash inflow to the contractor at the end of the investment's estimated service life. Salvage value, if significant, should be entered for the last year of the asset's depreciable service life. For applicable depreciation methods, salvage value is automatically deducted from the CAS 409 depreciable basis when it is 10 percent or more of acquisition costs.

11. Contractor Before-Tax Cash Flow. Before-tax cash flow to the contractor is the difference between all cash outflows and all cash inflows to the contractor. Cash outflows are contractor investment (Line 1) and contractor expenses (Line 2). Cash inflows are the sum of DoD cash flows to the contractor (Line 9) and salvage value (Line 10). Annual contractor before-tax cash flow is then the sum of Lines 1, 2, 9, and 10, where outflows are treated as negative values and inflows are positive.

The DCF Model automatically calculates contractor before-tax cash flow. The sign of the annual value denotes whether the contractor enjoys a net inflow (positive) or outflow (negative).

Generally, contractor before-tax cash flow is negative (an outflow) in the early years of the analysis, as a result of the facilities acquisition. The cash flow stream usually turns positive (a net inflow) following the facilities acquisition and remains positive for a number of years. A net outflow may reoccur when the undepreciated book value of the assets declines to a low value and depreciation, CAS 414 payments, and weighted guidelines profit on facilities capital employed are concomitantly low and the negative impact of profit reductions is dominant.

TAX CALCULATIONS (LINES 12-16)

The objective of the next five lines is to calculate the contractor's Federal income tax consequences arising from the investment. Once tax liability is determined, contractor after-tax cash flow can be determined as the difference between before-tax cash flow and the incremental tax consequences of the investment.

12. Accelerated Cost Recovery System (ACRS) Depreciation. Additional contractor net cash revenues are subject to Federal income taxes. Under tax law, the contractor is allowed to deduct depreciation charges from additional net cash revenues, using ACRS depreciation guidelines. Additional contractor net cash revenues, less ACRS tax depreciation charges, determine incremental income subject to Federal income taxes. ACRS tax depreciation is computed on the basis of the investment (Line 1) and the ACRS tax depreciation method selected; two methods are provided.

Method 1. Standard ACRS Tables for Three-, Five-, and Ten-Year Cost-Recovery Classes: This method uses rates provided by standard IRS tables for the various cost-recovery classes. The rates in these tables are applied to the adjusted acquisition cost. If a full investment credit is taken for the particular class (10 percent for five- and ten-year and 6 percent for three-year), the depreciation base is reduced by one-half the investment credit taken. Salvage value is ignored under this method.

Method 2. Straight line: In lieu of the standard ACRS depreciation allowances, the user may select the straight-line method. The annual depreciation allowances are computed according to the specified asset service life without regard to salvage value.

13. Contractor Taxable Income. Income subject to Federal income tax is the difference between the contractor's additional net cash revenues and ACRS tax depreciation charges. Additional net cash revenues associated with the facilities investment are DoD cash flows to contractor (Line 9) plus salvage value (Line 10) minus contractor expenses (Line 2). Taxable income in Line 13 is thus additional net cash revenues (Line 9 plus Line 10 minus Line 2) minus ACRS depreciation charges (Line 12). Taxable income is computed automatically by the DCF model for each year covered by the analysis.

14. Contractor Income Tax. Income subject to Federal income tax, given by Line 13, times the contractor's applicable Federal income tax rate, determines the dollar value of the Federal income tax liability. The user must provide the contractor's marginal tax rate applicable to Federal taxable income. The model defaults to 46 percent, the current statutory maximum rate for corporations. Generally, this should be the rate used to determine Federal taxes and resulting after-tax cash flow.

The contractor's effective Federal tax rate as seen in annual reports and Securities and Exchange Commission filings will often be less than 46 percent. This is so because it represents an average, not a marginal rate and because it represents the ratio of Federal tax to accounting income. However, accounting income and taxable income are often very different, because of tax preferences such as ACRS depreciation, investment tax credits, and deferrals under the completed contract method. Thus the DCF Model calculates taxable income subject to the 46-percent rate, taking account of all the required adjustments. In the case of the completed contract method of accounting, a user-specified lag is provided in the DCF Model. The user specifies the number of years by which the cash outflow for income taxes lags behind the accrued tax liability. A two-year lag, for example, means that the tax liability for Year 1 is paid in Year 3, the liability for Year 2 is paid in Year 4, and so on. All unpaid taxes are assumed paid in the final year of the analysis. Finally, note that income

tax refers only to Federal income taxes; state, local, and other taxes are allowable costs and are generally reimbursed as indirect costs (see FAR 31.205-41).[3]

15. Investment Tax Credit. An investment tax credit is added to contractor cash inflow or, equivalently, subtracted from the contractor's tax liability, to reflect the investment tax credit applicable under tax law. The credit is generally calculated using 10 percent of the asset's capitalized acquisition value and credited when the asset is first placed in service. A 6-percent credit applicable to assets in a three-year cost recovery class is also possible. The DCF Model automatically applies a 10-percent investment tax credit for the year the asset is placed in service and capitalized. The 10-percent credit is applied to the cumulative value of Line 1 investment up to the time the asset is placed in service. The user can override the 10-percent credit with another value (e.g., the 6 percent applicable to the three-year cost recovery class).

16. Contractor After-Tax Cash Flow. This stream represents the incremental net cash flow accruing to the contractor as a result of the investment. This stream is the one representing the *financial outcome of the contractor's* investment and the one from which an IRR is computed. After-tax cash flow is computed by subtracting contractor income taxes, adjusted for any investment tax credit, from before-tax cash flow. Thus, the contractor's after-tax cash flow (Line 16) is the sum of Lines 11, 14, and 15, where a positive value reflects a cash inflow and a negative value a cash outflow.

SUMMARY (LINES 17-23)

The summary begins with DoD and Government benefits: a year-by-year tracking of costs and benefits arising from the contractor investment.

17-18. DoD Program Benefit. DoD program benefit represents the annual net benefit, if positive, or cost, if negative, from the IMIP investment. This value is the savings available to DoD (Line 4) less any PSR payment (Line 5) and DoD/Government funding (Line 3). Typically, DoD program benefit is negative (i.e., a cost) in early years of the analysis, when funding and cash flow

[3]The flexibility in tax rates and in lag should be able to represent most situations. If, however, the contractor's tax situation is such that the model's computations cannot provide an acceptable estimate of the tax effects, the user should make year-by-year estimates of the Federal income tax and supply them directly to Line 14.

payments by DoD to the contractor are at high levels. Line 17 gives DoD program benefit when the PSR of Line 5 is set at zero. The purpose of this calculation is to indicate the magnitude of DoD program benefit without an incentive payment. (This amount is the maximum available for sharing.) Line 18 shows DoD program benefit after deduction of the PSR.

19. DoD Payback Period. DoD and Government returns are indicated by payback periods: the number of years from the time benefits are first negative until they become positive. Payback is a particular representation of return where discounting is not performed and the value of benefits and costs beyond the payback period is not considered.[4] Payback period represents the time required to match DoD-incurred costs with benefits. DoD benefits are likely to be negative (i.e., costs) during the early period of the analysis, since savings (benefits) are usually phased in slowly and related costs, such as depreciation and CAS 414 payments, are at their highest level during that period. The model automatically computes the DoD payback period using DoD program benefit (Line 18). Payback period is computed as the amount of time the cumulative value of Line 18 is negative.

20. Government Benefit. This value is found by adding the contractor's tax payment, less any investment tax credit, to the net DoD program benefit. Generally, Government benefit exceeds DoD program benefit and thus the Government payback period is shorter than the DoD payback period. The model automatically computes Line 20, Government benefit, by adding contractor income tax (Line 14) to DoD program benefit (Line 18) and deducting investment tax credit (Line 15). Thus, the PSR payment is always considered in the calculation of Government benefit.

21. Government Payback Period. This measure of return to the Government is calculated on the basis of the Line 20 benefit/cost stream. It represents the time required for the Government to recoup, in the form of benefits, all Government cost incurred for the project. The model automatically computes the Government payback period by considering the amount of time the cumulative totals of Line 20 are negative.

[4]If desired, individual users can easily discount the value of DoD and Government benefit streams.

22. Contractor IRR. The contractor IRR is a measure computed from the after-tax cash flow stream reported in Line 16. The IRR associated with this cash flow represents the discount rate that equates the present value of cash inflows to the present value of cash outflows. The model automatically computes two IRRs: one rate is based on the after-tax cash flow stream reported in Line 16, which includes the proposed PSR; the other is based on the after-tax cash flow stream (not shown in the model report) without any proposed PSR. The latter IRR sets a floor that may be increased by paying an incentive.

There are a number of possible outcomes for the calculation of the IRR. There may be a unique positive IRR for the cash stream -- the usual result for a cash stream consisting of initial contractor investment followed by cash inflows from DoD in later years. However, cash streams can occur that have no positive IRR, have an infinite IRR, or have several positive IRRs that are equally correct (multiple solutions).[5]

The model incorporates tests to determine a condition code describing the possible outcomes for the IRRs for a given cash stream. To determine the applicable condition code, the model uses tests described in "Evaluating and Comparing Projects: Simple Detection of False Alarms," from the Journal of Finance, Vol. XXXIV, No. 5, December 1979, pages 1231-1242. These tests involve counting the number of sign changes in the cumulative cash flow stream. The article provides an excellent discussion of the possible conditions and techniques for finding additional IRRs when more than one may exist.

The following paragraphs describe the possible condition codes:

Condition 1. Unique Positive IRR: This is the most common condition. An IMIP project usually consists of an initial contractor outflow for an investment followed by cash inflows. In this situation, a unique positive IRR exists and should be calculated by the model.

[5]Investments yielding net cash flow streams with multiple IRRs are relatively rare. The possibility of multiple positive IRRs is a common criticism of the use of IRR analyses for financial decisionmaking. When there are multiple positive IRRs, there is no one "correct" IRR for the cash stream. A typical investment project, consisting of negative cash flows in the beginning years of the project followed by positive cash flows for the remaining years, does not have multiple positive IRRs.

In most instances the model is able to find the IRR, using the IRR routine built into the Lotus 1-2-3 program. The routine is sometimes unable to compute the actual solution and either an "ERR" is returned (indicating that the algorithm was unable to converge to within .0000001 of the correct answer after 20 iterations), or a negative IRR is found before the existing positive IRR.[6] If a condition code of 1 is indicated, then a unique positive IRR does exist, even though the routine built into the Lotus 1-2-3 program may have been unable to find it.

Condition 2. No Positive IRR: The model will return an "NA" (indicating IRR not available) for this situation. This condition occurs when the cash inflows to the contractor are insufficient to compensate for the contractor's cash outflows and the cumulative cash flow stream is always negative. In this situation, there is no positive discount rate that will equate the cash inflows to the cash outflows. Increasing the cash flows to the contractor by changing the model inputs (e.g., the amount of PSR) may result in a positive rate of return.

Condition 3. Infinite IRR: The model will return an "NA" (indicating IRR not available) for this situation. This condition occurs when the net cash flow stream is always positive (no net outflows). The contractor receives enough cash inflow early in the project so that the net cash flow is positive and effectively no net outflow is ever incurred; hence, the return on investment is infinite. Changing the model inputs to reduce early cash inflows (e.g., reducing or delaying the PSR) may result in a cash flow for which an IRR exists.

Condition 4. Possible Multiple IRRs: This condition is indicated when the test is unable to determine conclusively that a unique positive IRR exists (Condition 1) or that no positive IRR exists (Condition 2). Consequently, the cash stream may have multiple IRRs, a unique positive IRR, or even no IRR. Further analysis is needed to determine which situation applies. If this condition is indicated, the user must be careful in interpreting the resulting IRR.

[6]The Lotus 1-2-3 IRR routine needs a beginning value to compute the actual IRR for a given cash stream. The solution algorithm can be sensitive to this beginning value. If the estimate is too far away, a negative value or "ERR" may be computed. The DCF Model uses a table lookup technique to find an initial estimate close to a positive IRR, so that the algorithm will converge correctly. However, even with this educated guess, the Lotus routine may still be unable to compute an IRR for some atypical cash streams.

If a positive IRR value is computed by the Lotus 1-2-3 IRR routine, and Condition 4 is reported, the cash stream has at least one positive IRR and possibly more. Hence, Condition 2, no positive IRR, can be ruled out for this cash stream. However, the model is unable to determine the number of positive IRRs for the stream.

If the computed value is negative or "ERR," the built-in Lotus 1-2-3 IRR routine was unable to find any positive IRRs; however, positive IRRs may exist. Condition 4 with a negative value or an "ERR" implies the need for more analysis or a change of inputs. Modification of the timing proposed for the PSR may reduce the number of sign changes in the cumulative cash flow stream. Computation of present values for the contractor's after-tax cash flow (Line 16) at a few selected discount rates may provide some insight.

23. Contractor Payback Period. In addition to IRR as a measure of the financial outcome of the contractor investment, a payback period computation is included in the model. Payback period tells the contractor the number of years required to recoup his investment-related cash outflow. As with any payback computation, the time value of money (i.e., discounting) and the value of benefits beyond the payback period are not considered. Contractor payback includes the PSR payment and represents the number of years from the point where the cumulative after-tax cash flow is first negative to the time when it becomes positive.

3. DEPARTMENT OF DEFENSE BENEFIT ANALYSIS

The essential ingredient in an IMIP deal is a reduction in contract price, made possible because the investment results in lower cost and profit. If the price reduction is great enough, there can be shared savings to benefit both the contractor and the Government. This chapter discusses the concepts involved in quantifying the reduction in contract prices, called savings available to DoD.

The analysis of potential benefits requires comparing the contract prices that would be expected under two very different situations: (1) "business as usual," without the proposed productivity enhancement, and (2) production after the installation of the improvement. Comparison of contract price implies the ability to estimate, under both sets of conditions, the cost and also the profit objective to be reached under DoD's weighted guidelines. Only after comparison of both costs and profits on a year-by-year basis can we determine the total savings available that can be shared between the contracting parties.

Comparing costs and profits under two different production situations requires attention to every aspect of contract price that might change as a result of the proposed IMIP investment. Some elements of cost and profit may increase, while others will fall. The analysis determines the *incremental* price changes (savings) associated with the proposal. Established rates, used for pricing in the "business as usual" situation, will almost never serve adequately in connection with this after-investment comparison, either for indirect cost effects or for profit effects.

For example, if the proposal will substitute automated machine work for manual operation, direct labor costs will be reduced. At the same time there will probably be increases in overhead, not only for the depreciation on the new machine, but also for any special support costs related to the proposed investment. Overhead *rates*, therefore, can generally be expected to go up when there are reductions in direct labor costs; contract price reductions will nevertheless be expected.

An investment in facilities can also have a dramatic effect on profits, when profit is expressed as a percentage of estimated cost. The profit objective will change, because individual cost categories

change and because more facilities capital is used. The use of old profit percentages would not reflect these effects.

BENEFIT ANALYSIS FORMAT

For later development of an equitable arrangement for sharing the savings, the analysis should result in two schedules: (1) the year-by-year change expected in contractor profit and (2) the year-by-year change expected in contract price. Both schedules require, first, an analysis of the year-by-year changes in production cost. The format shown on Table 3-1 provides a logical framework for the analysis of any one year. It represents a conceptually complete display of the factors that result in changes in profit and price. (The form is comparable to DD Form 1547, "Weighted Guidelines Profit/Fee Objective.") It is designed to help recognize the effects that cost and investment changes should have on the profit objective as well as on the recognized contract cost. The format is essentially in two parts. The top portion compares the costs as they are used to measure "contractor effort" under the weighted guidelines profit policy. The cost changes are in turn used as the basis for finding the potential impact on profit objectives. The lower portion deals with those elements of cost and profit that are not part of the "contractor effort" as displayed in Part I of DD Form 1547. Those elements are (1) the profit based on contractor cost risk; (2) the weighted guidelines profit based on facilities capital employed (FCE); and (3) the imputed cost of money (CAS 414), based on FCE. Both sections are fairly straightforward. The data to be entered are described on a line-by-line basis, as follows:

Lines 1-7 (Contractor Effort). The same procedure applies to all elements of cost used to measure contractor effort. Estimated annual cost under the old method, or the situation to be expected without the IMIP proposal, is entered in Column 1. Comparable annual cost under the new method, or the situation to be expected after adoption of the proposal, is entered, for each cost element, in Column 2. The difference (Column 2 minus Column 1) is entered in Column 3 (a cost-reducing proposal may include increases in some cost elements, but the major differences should be reductions). Column 4 is for the profit rate applicable to each element of contractor effort (ranges are in DoD FAR Supplement 15.902(a) (1) (v) and on DD Form 1547). Column 5 is to show the expected

TABLE 3-1. DoD BENEFIT ANALYSIS

COST AND PROFIT ELEMENTS OF PRICE	1 OLD METHOD ($) COSTS	2 NEW METHOD ($) COSTS	3 INCREMENTAL COST IMPACT (2) - (1)	4 PROFIT %	5 PROFIT CHANGE ($) (3) x (4)	6 ANNUAL PRICE CHANGE($) (3) + (5)
Contractor Effort						
1. Material Acquisition						
2. Engineering Labor						
3. Engineering Overhead						
4. Manufacturing Labor						
5. Manufacturing Overhead						
5.1 CAS 409 Depreciation						
5.2 Property Tax						
5.3 Insurance						
5.4 Maintenance						
5.5 Non-capitalized Investment Costs						
5.6 Other Manufacturing Overhead						
6. Other Costs						
7. G&A						
8. Subtotal: Cost and Profit Changes						
9. Weighted Guidelines Adjustment Factor (-30%)					-30% of Above Subtotal	
10. Weighted Guidelines Profit on Cost Risk			Subtotal Above (Line 8)			
11. Subtotal						
	FACILITIES CAPITAL EMPLOYED (FCE) AND CAS 414 EFFECTS					
	FCE OLD METHOD ($)	FCE NEW METHOD ($)	CHANGE IN FCE (2) - (1)	RATE (%)	PROFIT CHANGE ($) (3) x (4)	PRICE CHANGE($)
12. Weighted Guidelines Profit on FCE						
13. CAS 414 Imputed Cost of Money						
GRAND TOTALS					Profit Effect	Savings Available to DoD

profit effect; for each cost element, the cost effect (in Column 3) is multiplied by the rate (in Column 4). Column 6 is for the price effect, the sum of the cost effect (in Column 3) and the profit effect (in Column 5).

Line 8 (Subtotal: Cost and Profit Changes). The incremental cost, profit, and price effects listed in Lines 1 through 7 are totaled and summarized here. The entries in Columns 3 and 5 are sums of the numbers above them. The entry in Column 6 is the sum of those in Columns 3 and 5.

Line 9 (Weighted Guidelines Adjustment Factor). A 30-percent adjustment is entered on Line 14 of DD Form 1547 to reduce the portion of the profit objective based on contractor effort. In Column 5, enter 30 percent of the subtotal shown at Line 8, Column 5, with a sign opposite to that on Line 8. For most IMIP proposals, this adjustment is a positive value, because it is an offset to the amount of profit reduction. In Column 6, enter the same adjustment as in Column 5.

Line 10 (Weighted Guidelines Profit on Cost Risk). The profit policy at FAR 15.905-1(b) includes recognition of the contract cost risk. In Column 4, enter the appropriate rate, in accordance with DoD FAR Supplement 15.905-1(b)(7). In Columns 5 and 6, enter the product of the rate times the total cost change shown in Line 8, Column 3.

Line 11 (Subtotal). Summarize those profit and price changes not related to facilities capital, by adding (recognizing the impact of signs) the entries in Lines 8, 9, and 10, above. The sums are entered in Columns 5 and 6.

Line 12 (Weighted Guidelines Profit on FCE). In Columns 1 and 2, show the dollar amount of FCE both without the IMIP proposal and under the proposal. Enter, in Column 3, the increase in FCE, determined by subtracting the Column 1 entry from that of Column 2; for simple cases this increase may be entered directly in Column 3. In Column 4, enter the appropriate profit factor applicable to FCE, as used for Line 17 on DD Form 1547. In Columns 5 and 6, enter the FCE-related profit, the product of the entries in Columns 3 and 4.

Line 13 (CAS 414 Imputed Cost of Money). Enter, in Column 3, the change in FCE from Line 12, Column 3. In Column 4, enter the applicable "CAS 414" rate for the imputed cost as prescribed in FAR 31.205-10. In Column 6, enter the expected imputed cost, the product of the entries in Columns 3 and 4.

Grand Totals. In Column 5, enter the sum of the Column 5 entries on Lines 11 and 12. In Column 6, enter the sum of the Column 6 entries on Lines 11, 12, and 13.

AUTOMATED BENEFIT ANALYSIS

Preparation of the detailed analysis represented by Table 3-1 for each year would require repetitive clerical work. Many of the facilities-related entries (depreciation, profit on depreciation,

imputed cost of money, and profit on facilities capital) have different values for each year, while the savings in direct cost may be the same for each year once the improvement has been fully implemented. For convenience, the annual estimates have been automated as part of the DCF Model. Appendix A describes the model's benefit analysis.

For most IMIP arrangements, the determination of the available potential savings and the expected change in weighted guidelines profit objective will be developed once as an early part of the proposal's description. The resulting schedules of profit effect and available savings will be among the significant input values for use in the DCF analysis, which is the subject of Chapter 2.

APPENDIX A

AUTOMATED BENEFIT ANALYSIS

As explained in Chapter 2, the Discounted Cash Flow (DCF) Model's basic report (Table 2-1) includes, at lines 4 and 8, the results of a benefit analysis. These two lines are the final two lines of the model's benefit analysis report form, Table A-1.

TABLE A-1. BENEFIT ANALYSIS REPORT FORM

	BENEFIT ANALYSIS	1986	1987	1988	1989
	Computed Net Cost Reduction:	---	---	---	---
B 1	Material Acquisition	---	0.0	0.0	0.0
B 2	Engineering Labor	---	0.0	0.0	0.0
B 3	Engineering Overhead	---	0.0	0.0	0.0
B 4	Manufacturing Labor	---	0.0	0.0	0.0
B 5	Depreciation (CAS 409)	(0.0)	(0.0)	(0.0)	(0.0)
B 6	Other Manufacturing Overhead	---	0.0	0.0	0.0
B 7	Other Costs	---	0.0	0.0	0.0
	Subtotal, Cost Input Before G&A	0.0	0.0	0.0	0.0
B 8	General & Admin. Expense	---	0.0	0.0	0.0
	Total Cost Change (Except CAS 414)	???	0.0	0.0	0.0
	Computed Profit Effect:				
B 9	Material Acquisition	---	0.0	0.0	0.0
B 10	Engineering Labor	---	0.0	0.0	0.0
B 11	Engineering Overhead	---	0.0	0.0	0.0
B 12	Manufacturing Labor	---	0.0	0.0	0.0
B 13	Manufacturing Overhead	0.0	0.0	0.0	0.0
B 14	Other Costs	---	0.0	0.0	0.0
B 15	General & Admin. Expenses	---	0.0	0.0	0.0
	Subtotal, Before 30% Adjustment	0.0	0.0	0.0	0.0
B 16	Profit Adjustment Based on Effort	0.0	0.0	0.0	0.0
B 17	Profit Change for Changed Cost Risk	0.0	0.0	0.0	0.0
B 18	Profit on New Facilities Capital	0.0	0.0	0.0	0.0
	Summary, Profit Effect	???	0.0	0.0	0.0
	SAVINGS AVAILABLE TO DoD (Price Change) (Cost, Profit, and CAS 414)	???	0.0	0.0	0.0

The following discussion presents a line-by-line description of the Benefit Analysis.

B1 MATERIAL ACQUISITION

This is the time-phased net savings in material cost. For each year, except the first, the amount reported is the amount entered as the base or typical saving for material acquisition in the input section, adjusted by any change supplied as an input for that year. No savings is computed for the first year; the analyst may make a manual entry in the report line if desired.

B2 ENGINEERING LABOR

This is the time-phased net savings in engineering labor as a direct cost. For each year, except the first, the amount reported on this line is the amount input for the base reduction in engineering labor, adjusted by any input for change for that year.

B3 ENGINEERING OVERHEAD

This line shows the time-phased computation of the change in engineering overhead. The model provides for both fixed and variable components of engineering overhead. The fixed component is determined (like material acquisition and engineering labor, described above) from a base or typical amount of reduction and a specific change for each year. The variable component is computed on the basis of an input percentage; that rate is multiplied by the engineering labor change (line B2) for each year to find the variable change in overhead for the year. The amount reported on line B3 is the sum of the variable and fixed components. There is no need for inputs for either component. Overhead changes are not always to be expected.

B4 MANUFACTURING LABOR

The report for change in manufacturing labor is developed like that for engineering labor, described above for line B2.

B5 DEPRECIATION (CAS 409)

The amounts reported in this line are taken from line 7 of the basic DCF Model report (see Chapter 2), but with the sign changed. Increases in depreciation cause reductions in the net savings.

B6 OTHER MANUFACTURING OVERHEAD

Changes in manufacturing overhead (other than depreciation) are recognized in the same way as changes in engineering overhead, described above for line B3.

B7 OTHER COSTS

This report line is provided to cover any other cost changes. The report for each year is the base amount supplied as an input value, adjusted by any change supplied for that year as an input.

SUBTOTAL, COST INPUT BEFORE G&A [general and administrative expense]

This report line is a summation of the amounts on lines B1 through B7.

B8 GENERAL AND ADMINISTRATIVE EXPENSE

The model allows for both fixed and variable components of G&A. Changes in the fixed component are recognized from a base amount and year-by-year adjustments, if supplied. The variable component is computed from a percentage (input value) multiplied by the total change computed for cost input before G&A (sum of lines B1 through B7). The year-by-year amounts on line B8 are the sum of the fixed and variable component changes.

TOTAL COST CHANGE (EXCEPT CAS 414).

This year-by-year list of computed net cost reduction is one of the three elements of savings available to DoD. The year-by-year totals are the sums of the amounts determined for lines B1 through B8. No total is developed for the first year; manual inputs for the first year may be entered directly for the output report lines 4 and 8, if desired.

COMPUTED PROFIT EFFECT (Lines B9-B18)

These amounts are developed from input values and the cost reductions reported in lines B1 through B8. The input values representing midpoints in the current weighted guidelines (for manufacturing) are furnished as default values by the model. The analyst may change to any profit percentage deemed more appropriate to the case under consideration. The computation follows that prescribed in DD Form 1547, "Weighted Guidelines Profit/Fee Objective." The individual calculations are described below:

B9 Material Acquisition

Profit rate times amounts on line B1.

B10 Engineering Labor

Profit rate times amounts on line B2.

B11 Engineering Overhead

Profit rate times amounts on line B3.

B12 Manufacturing Labor

Profit rate times amounts on line B4.

B13 Manufacturing Overhead

Profit rate on manufacturing overhead times net change in overhead, which is the result of combining lines B5 and B6.

B14 Other Costs

Profit rate times amounts on line B7.

B15 General & Administrative Expenses

Profit rate (applicable to other costs) times amounts on line B8.

Subtotal, Before 30% Adjustment

This line is a report of the summation of the amounts on lines B9 through B15.

B16 Profit Adjustment Based on Effort

The amounts reported on this line are 70 percent of the amounts reported directly above them. This modification gives effect to the 30-percent adjustment factor required for manufacturing contracts.

B17 Profit Change for Changed Cost Risk

The rate of profit applicable to cost risk is an input value; it is sensitive to contract type. This profit rate is multiplied by the computed total cost change (reported following line B8) to find this part of the reduction in profit.

B18 Profit on New Facilities Capital

The rate of profit for facilities capital employed is an input value. This rate is multiplied automatically by the remaining book value as used in determination of imputed cost of money for line 6 of the basic DCF report. This procedure finds the *increase* in profit derived from the IMIP investment.

Summary Profit Effect

The sum of lines B16, B17, and B18 (recognizing the signs) provides the net change in profit. For each year except the first, this computed profit effect is carried automatically to line 8 of the basic DCF report.

Savings Available to DoD (Price Change)

The total potential price reduction is the sum of the cost reductions (reported following line B8), the increase in cost of money (line 6 of the basic DCF report), and the net profit effect. This sum is carried automatically, for each year except the first, to line 4 of the basic DCF report.

APPENDIX B

SPECIFIC OPERATING INSTRUCTIONS

This Appendix describes the system requirements for operation of the Discounted Cash Flow (DCF) Model described in Chapter 2. It also includes general guidance for users of the model.

SYSTEM REQUIREMENTS

The DCF Model is implemented as a template for Lotus 1-2-3,[1] one of the popular "electronic spreadsheet" programs, which runs on the IBM personal computer and IBM-compatible personal computers such as the COMPAQ. To use the model, you will need a personal computer that can run Lotus 1-2-3, disk drives that can read the data diskette on which the model is distributed, and sufficient random access memory to hold the Lotus 1-2-3 program, the computer disk operating system (DOS), and the DCF Model template. You must also ensure that your Lotus 1-2-3 program and DOS are compatible. There are currently several different versions of DOS for the IBM personal computer (e.g., 1.10, 2.00, and 2.10). There are two versions of Lotus 1-2-3, Release 1 and Release 1A. The DCF Model will work with either of the Lotus 1-2-3 versions, and the model data diskette has been written so that it can be read under any DOS version. DOS Versions 2.00 and higher are not compatible with Release 1 of Lotus 1-2-3.

The software and memory requirements for using the model will depend on the versions of Lotus 1-2-3 and DOS that your system uses. The following list provides the system requirements to use the DCF Model:

- IBM personal computer or IBM-compatible personal computer capable of running Lotus 1-2-3, and reading the data diskette on which the model is stored;
- Two double-sided disk drives, or one double-sided drive and a hard disk;
- Display monitor (black-and-white or color);
- Printer (not essential);

[1] Lotus 1-2-3 is a trademark of Lotus Development Corporation.

- Lotus 1-2-3 software:
  - Release 1 requires IBM DOS Version 1.10 and a minimum of 192K of memory (preferably 256K);
  - Release 1A (a newer version) requires an IBM DOS Version 1.10, 2.00, or 2.10 and a minimum of 256K of memory;
- IBM DOS:
  - Version 1.10 with Release 1 of Lotus 1-2-3;
  - Version 1.10, 2.00, or higher with Release 1A of Lotus 1-2-3.

Memory Requirements

The DCF Model has been designed to analyze business deals ranging from one to a maximum of 15 years in duration. The memory required to operate the model will depend on the number of years to be analyzed and also on the versions of DOS and Lotus 1-2-3 that your system uses. The newer versions of DOS (Versions 2.00 and 2.10) and Lotus (Release 1A) have more features and, consequently, require more memory. Regardless of the DOS and Lotus versions used, more memory is needed to use the model to examine time frames of from 10 to 15 years. Table B-1 provides the total memory requirements for various analysis time periods and software combinations.

TABLE B-1. DCF MODEL MEMORY REQUIREMENTS

	LOTUS RELEASE 1 DOS 1.10	LOTUS RELEASE 1A DOS 1.10	LOTUS RELEASE 1A DOS 2.00
DCF Model (with 2 years)	133K	139K	152K
expanded to 10 years	186K	193K	205K
expanded to 15 years	218K	226K	238K

NOTE: Each additional analysis year between two and 15 requires an additional 6.7K of memory.

GETTING STARTED

Many different combinations of computer hardware and operating systems are possible. The following instructions are intended to fit most situations:

Load Lotus 1-2-3

The technique for loading will vary. If your Lotus 1-2-3 system diskette has been configured to boot up into Lotus 1-2-3, you may skip several of these steps.

- Turn on your computer and load the DOS.
- Put Lotus 1-2-3 system diskette into Drive A.
- Type the following:

  A:LOTUS.

- Press the ENTER key.
- Press the ENTER key. (The first time you selected LOTUS; this time you are selecting 1-2-3.)
- Press any key (to clear the trademark from the screen).

Load DCF Model

- Put data diskette containing the DCF Model program into Drive B.
- Type the following:

  / F R LMIDCF2 (ENTER).

  (The "/" brings a menu. You may select "FILE", "RETRIEVE", and "LMIDCF2" by cursor and "ENTER" if you prefer.)

MODEL MENU

Like Lotus 1-2-3, the model is menu driven. To reach the model's menu, press "M" while holding down the "ALT" key[2]. You may then select, by initial letter or by cursor and "ENTER", any of the following: INPUT, CALCULATE, REPORT, SUMMARY, ADD YEARS, PRINT.

Each of these is described below.

[2]On Zenith 100 personal computers there is no "ALT" key. Press the "CTRL" and "Shift Upper Case" keys for the equivalent of the "ALT" key.

ADD YEARS

This selection, usually at the beginning of the analysis, provides columns (for input and output values) for as many years as is desired. The basic form of the model provides for only two years. (This small size reduces the file requirement.) After selecting this option, the user is asked the number of years. Simply type the number, followed by "ENTER". The program will automatically copy the second year's column the requisite number of times, and will then transfer the cursor to the input section.

If "ADD YEARS" is selected after inputs have been supplied, the user should review the resulting input section and correct it if any values were inadvertently duplicated into later years.

INPUT

Selection of this option will bring the cursor to the input section, ready for the user to enter or change the specific descriptions and values on which calculations are to be based. A complete run of the model is accomplished by specifying a number of inputs. After an original description of a proposal, the user will normally return to this section to make only one change or a few changes in inputs at a time.

To enter specific numeric values in the input section, the analyst uses the cursor control keys to locate the appropriate row and column. The correct value should be keyed, checked at the terminal display, and entered (by the "ENTER" key). Blanks or previous values will be superseded when new entries are supplied. The analyst may decide on an appropriate scale; often it will be convenient to enter dollar amounts in thousands. Do not use dollar signs or commas; decimal points may be used if desired. Percentages should be entered as decimal equivalents. After any change of input values, recalculation is necessary. Table B-2 shows the format for entering input values. It consists of three parts: the PSR to be analyzed, contract cost effects, and investment-related data.

CALCULATE

Selection of this option will cause the complete reevaluation of all values, after which the cursor will shift to the summary portion of the report.

TABLE B-2. INPUT VALUES

```
          INPUT VALUES                                          1987     1988     1989
                                                               ------   ------   ------
        Productivity Savings Reward

        Reductions in Out-of-Pocket Costs:
Profit                                  Variable
Rates                                   Overhead      Base   Change   Change   Change
 0.025 Material Acquisition             Rates          0.0
 0.120 Engineering Labor                                0.0
          Changed Engr O'head (Amount)                  0.0
          Variable Engr O'head (Rate)     0.000
 0.070 Manufacturing Labor                              0.0
          Changed Mfg. O'head (Amount)                  0.0
          Variable Mfg. O'head (Rate)     0.000
 0.070 Other Costs                                      0.0
        Input Other Factors:
          Changed G & A (Amount)                        0.0
          Variable G & A (Rate)           0.000
 0.070   Rate of Profit on Cost Risk
 0.180   Profit on Facilities Capital
        Proposed Improvement:           Year          1986     1987     1988     1989
                                                     ------   ------   ------   ------
        Contractor Investment  ................
        Contractor Expenses  ..................
        DoD/Government Funding  ...............
        Salvage Value  ........................
        CAS 414 Rate  ................   xx.xx%.....................................
        CAS 409 Depreciation:  ...... ..............................................
           Depreciation Method  ......        1 ......................................
              (1:Straight Line; 2:Sum-of-Years; 3:Sum-of-Years/Half-Year;
               4:150% Declining Balance; 5:150% DB, Switch to St Line)
           Asset Service Life (years)         8 ......................................
           Year Placed into Service           1 ......................................
        ACRS Depreciation:  ...................................................
           Depreciation Method  ......        1 ......................................
              (1:Standard ACRS Tables; 2:Straight Line) ..........................
           Asset Class  (Service Life)        5 ......................................
              (3: 3-yr; 5: 5-yr; 10: 10-yr) ......................................
           Year Placed into Service           1 ......................................
        Contractor Tax Rate  .........     0.46 ......................................
        Investment Tax Credit Rate  ..      yy% ......................................
    Completed Contract - Tax Lag              0  years  (0 implies no lag)
```

After any change in inputs has been made, a reminder ("CALC") is lit at the bottom of the screen.

SUMMARY

This choice will bring the lower portion of the report to the screen, so that the user can examine the benefits, internal rates of return (IRRs), and payback periods.

REPORT

This choice is equivalent to pressing the "HOME" key; it will bring the top of the model's basic report form into view. Use the cursor controls to examine all parts of the report.

PRINT

This menu choice will lead to a further set of choices, depending on what report is desired. The available selections are "ANALYSIS, INPUTS, BENEFITS, and PRINT-ALL." Their meanings are described below. It is also possible to use the Lotus 1-2-3 techniques to prescribe and print other reports and to modify any provisions related to paper and type size.

Analysis. This selection will produce a report such as that of Table 2-1, the basic DCF report.

Inputs. Selection of the "Input" report will result in a printed report of the input factors that were considered. (See Table B-2.)

Benefits. Selection of the "Benefit" report will result in production of the "Benefit Analysis" (Table A-1), which shows the savings available to DoD and the profit effect.

Print-All. This selection will cause the production of all three regular reports.

FILES

Reaching an IMIP agreement often requires several preliminary efforts. It may be necessary to save the worksheet representing the current state of analysis of a proposed project. To save a complete file, provide a formatted diskette (in Drive B) and devise an appropriate file designation. Then type "/" to get the Lotus 1-2-3 main menu, followed by "F" (FILE), "S" (SAVE), and the name of the file. (If the diskette has an old file on the same project, decide whether to replace the old version or to change to a new file name.)

To continue analysis from a saved file, supply (in Drive B) the diskette containing the file and follow the instructions above under "Getting Started," except for the use of the individual file name instead of "LMIDCF2". (Note that the file contains the basic model as well as the specific inputs for this case.)

MANUAL INTERVENTION

As indicated above, the model uses descriptions of any specific proposal, provided in an input section, to develop an analytical report, or output. For most situations, there will be various changes in the input values as a proposal evolves; normally a user would not make entries in the "output" report area.

However, special conditions may be encountered where the model's calculations do not provide results that represent the particular case being analyzed. In such cases, the user should supply predetermined answers in the output section. The two most likely reasons for such direct inputs are depreciation and income tax. These are both briefly described below.

If the IMIP proposal is for the acquisition of a collection of facilities and equipment having various service lives, there may be no convenient way to use the input section to develop, in the report, the pattern of depreciation actually expected. In such cases, the user should prepare, outside the model, a schedule of the agreed-upon year-by-year depreciation. Using the cursor controls, enter on the line used for CAS 409 depreciation the amounts in each of the years of the period under analysis. Similarly, the user can make direct entries for the line used for Accelerated Cost Recovery System depreciation. Note that such predetermined depreciation amounts will be correctly used in the computation of the imputed cost of money (CAS 414), which is based on average unamortized facilities.

The flexibility provided in terms both of number of years of lag based on the completed contract method and of variations in the marginal tax rate will provide an accurate representation of most Federal income tax situations. If, however, the expected situation cannot be readily represented by model inputs, the user may intervene to supply the results of specific tax estimates prepared externally. Simply move the cursor to the output line marked "14. Contractor Income Tax" and supply the desired year-by-year results.

If a user is providing a direct input for income tax, he should be aware of how such action affects the model's ability to compute an IRR for the case with no contractor productivity savings reward (PSR). Model reports with manually furnished income tax figures to go with a specific

amount of PSR will show the IRR that is correct for that specific PSR; however, they will need correction to provide the IRR without such a reward. Or the user may override the IRR report in the summary section.

Once the user supplies direct inputs, either for depreciation or for income tax, these will remain unchanged; they will not be automatically recalculated after inputs are changed. For each new case, there will be a need to reconsider the appropriateness of the values supplied.

Direct inputs can be supplied for any of the values used in the model. When such manual intervention occurs, the model will no longer automatically perform all the computations described in the body of this report. The user must take care, when saving files, to avoid destroying a complete model by filing one with such manually supplied numbers.

APPENDIX C

CHANGES FROM LMI DCFM VERSION 1.00

The specific model documented in Chapter 2 is an improved version of the model that was provided on a preliminary basis to participants in the Industrial Modernization Incentives Program (IMIP) test. The following notes are furnished for the convenience of users acquainted with the earlier version.[1] The main changes are (1) automation of the benefit analysis, (2) revisions in the model's tax calculations to conform to changes in the tax law, and (3) improvements in the model's algorithms and reports about internal rates of return (IRRs). Each of these changes is described below.

AUTOMATED BENEFIT ANALYSIS

Because the facilities capital employed changes from year to year, preparing schedules of expected profit effect and gross savings available to the Department of Defense (DoD) on the form in Table 3-1 required considerable clerical effort, mostly using numbers also needed in the model's cash flow analysis. As a convenience to the user, we have provided for the automatic development of these essential inputs, on the basis of information supplied by the user to determine the changes expected in costs.

The user may, as before, provide manual inputs for savings available to DoD and for profit effect. Usually, however, it will be more convenient to provide the descriptive inputs.

TAX CHANGE

For most IMIP deals, the Accelerated Cost Recovery System (ACRS) is used for income tax depreciation. The preliminary version of the model used an early version of the ACRS depreciation tables. Some of the benefits of ACRS were rescinded by the Tax Equity and Fiscal Responsibility Act

[1] "Discounted Cash Flow Analysis for Formulating and Evaluating IMIP Proposals," Working Note RE301-1, January 1984, Logistics Management Institute.

of 1982. The revised version of the model reflects these changes by using the current (September 1985) tax tables.

INTERNAL RATE OF RETURN

The model uses a built-in Lotus 1-2-3 routine to compute IRR. This routine works well in most IMIP situations. Under some circumstances, especially at extremely high rates of return (100 percent or more), the routine was unable to compute an existing IRR because of inadequacy of the convergence algorithm. The new version of the model selects a more nearly exact starting point for the IRR routine so that IRRs will be computed for more cash streams.

The model also can fail to compute an IRR because one does not exist (see Chapter 2's discussion of the IRR). Also, analysts are concerned about the possibility of multiple IRR solutions for the same cash stream. The earlier version of the model did not provide any indication of the nature of the IRR solution. The new version provides a condition code indicating the nature of the computed IRR. The condition code is one of the following:

1 = Unique positive IRR;

2 = No positive IRR;

3 = Infinite IRR;

4 = Possible multiple IRRs.

The meanings of these codes are explained in Chapter 2.

OPERATING CONVENIENCE

Since it now has its own menu, LMI DCFM Version 2.00 is much easier to use than its predecessor. Now the user only has to remember one instruction (ALT-M) to cover several operations for which separate instructions previously were necessary.

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Determining the appropriate productivity savings reward under an Industrial Modernization Incentives Program agreement requires identification of the total potential reduction in contract price. The contract price must be determined for each of two situations, one with "business as usual" and one after the proposed productivity enhancement. Finding these two sets of expected contract prices requires consideration of changes in direct and indirect cost and changes in profit objectives in each year of the period under analysis.

Discounted cash flow analysis is the appropriate tool for evaluating the financial attractiveness to the contractor of a proposed investment. Contractor-related cash flow includes payments based on (1) depreciation, (2) imputed cost of money, and (3) profit, which is influenced by cost and by facilities capital employed. Contractor return on investment is usually evaluated in after-tax terms,

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which implies a need to consider the accelerated cost recovery system and investment tax credit provisions of the Internal Revenue Code.

The cash flow model documented in this report provides evaluations of proposed savings share provisions. It identifies the benefit to DoD and to the U.S. Government (including income tax effects). It measures the internal rate of return to the contractor. The parties are expected to evaluate several possible savings share arrangements in the process of developing an equitable contractual agreement.

END

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