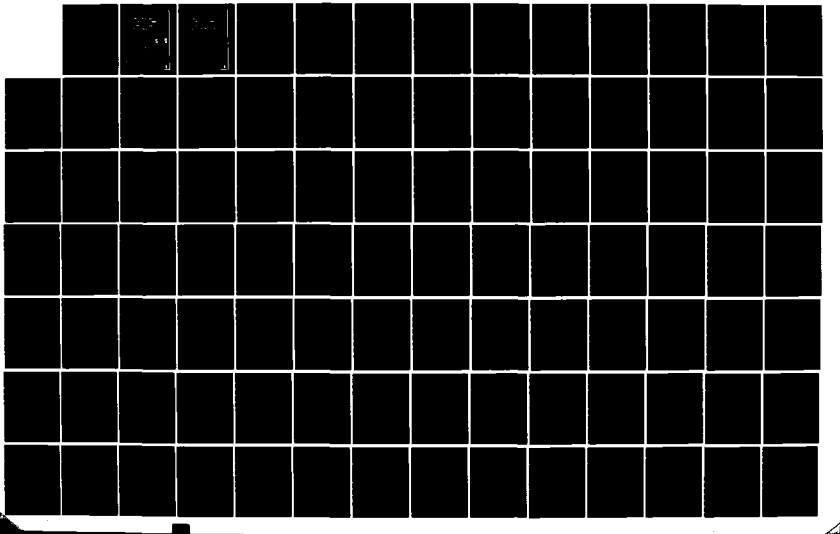
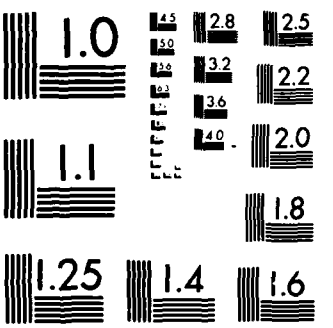
AD-A151 719 COMPUTERIZED PRODUCTION PROCESS PLANNING VOLUME 4 APPENDICES D E AND F TO BENEFIT ANALYSIS(U) IIT RESEARCH INST CHICAGO IL H H SHU ET AL. NOV 76 1/2

UNCLASSIFIED DAAH01-76-C-1104 F/G 5/3 NL





Manufacturing Methods and Technology

COMPUTERIZED PRODUCTION PROCESS PLANNING

VOLUME IV APPENDICES D, E, AND F TO BENEFIT ANALYSIS

Interim Report

November, 1976

Hsien-Hwei H. Shu
Janis C. Church
Jack P. Kornfeld

U.S. Army Missile Command

Contract No. DAAH01-76-C-1104

Prepared by: IIT Research Institute
Chicago, Illinois 60616

For: United Technologies Research Center
East Hartford, Ct 06108

IITRI

AD --------

Manufacturing Methods and Technology

COMPUTERIZED PRODUCTION PROCESS PLANNING

VOLUME IV APPENDICES D, E, AND F TO BENEFIT ANALYSIS

Interim Report

November, 1976

Hsien-Hwei H. Shu

Janis C. Church

Jack P. Kornfeld

U.S. Army Missile Command

Contract No. DAAH01-76-C-1104

Prepared by: IIT Research Institute

Chicago, Illinois 60616

For: United Technologies Research Center

East Hartford, Ct 06108

IITRI

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Computerized Production Process Planning Volume IV -- Appendices D, E, and F of Benefit Analysis		5. TYPE OF REPORT & PERIOD COVERED Interim Technical Report 30 Jun 76 - 30 Nov 76 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hsien-Hwei Hunter Shu Janis C. Church Jack P. Kornfeld		8. CONTRACT OR GRANT NUMBER(s) DAAH01-76-C-1104
9. PERFORMING ORGANIZATION NAME AND ADDRESS IIT Research Institute 10 West 35th Street Chicago, Illinois 60616		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Missile Command Redstone Arsenal, Alabama 35809		12. REPORT DATE November, 1976 13. NUMBER OF PAGES 165
14 MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19 KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer-aided manufacturing	Process planning
Computerized production process planning	Benefit analysis
Computer applications	Cost reduction
Production process planning	

20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

Presents detailed results of analyses of benefits of computerized production process planning.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DISPOSITION STATEMENT

Destroy this report when no longer needed.
Do not return it to the originator.

DISCLAIMER

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

TRADE NAMES

The citation of any commercial products, trade names, or manufacturers in this report does not constitute an official endorsement or approval of such items or companies by the United States Government.

Accession For	
NTIS GRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

APPENDIX D - COST BENEFIT ANALYSIS METHODOLOGY

Introduction

The cost benefit methodology developed for the analysis of alternative advanced scenarios of the process planning function was designed to provide several measures of worthiness. As with all investments there are alternative ways to measure their economic viability. In producing the analyses of the composite responses and structured characteristic corporate groups developed from the data, we present six different figures of merit; namely, benefit-to-cost ratio, years to pay back and return on investment discounted both before and after taxes and depreciation.

The concept of discounted cash flow is used in this analysis to develop the figures of merit. Cash flow, as used in the model formulations, represents the total amount of money generated by the project and available for other uses; it is the net profit after taxes plus depreciation. Depreciation, which must be considered in calculating profit, is not a cash expense and therefore affects cash flow only by reducing out-of-pocket income tax liability. Cash outflows are actual out-of-pocket expenditures while cash inflows are similar to money in the bank. The net cash flow is the difference between the cash inflows and outflows. In summary, cash flow is essentially a function of price, cost, volume, investment requirement, depreciation and tax structure.[1]

---

[1] For a detailed discussion of the discounted cash flow approach for economic evaluation see William R. Park's "Cost Engineering Analysis," John Wiley & Sons, New York, 1973.

Discounting is used for two basic reasons. First, by reducing all expenditures and receipts to present value we can place a single value on funds disbursed or received in diverse time periods. A dollar in hand thus has a higher intrinsic value than a dollar to be received ten years hence. Discounting future costs and benefits to present value restores future dollars to the utility of present dollars. Second, the use of an interest rate or discount factor allows for a realistic and comparable appraisal of the investment opportunities offered by alternative projects extending over diverse periods of time. Both private industry and government today use discounted cash flows to produce comparative evaluations of investment opportunities. A ten percent discount rate was used in the cost analyses of the alternative cases. Discounted cash flow is therefore used as the basis of the figures of merit subsequently discussed herein.

I - Benefit Cost Ratio

In this section we will portray the mechanics of cash flow, provide a description of the data elements, describe the computational methodology, describe the formula used to derive the benefit cost ratio, and provide a generalized cost benefit chart.

Mechanics of Cash Flow

For each of the process planning advanced scenarios the survey data and data relating to structured composites was developed for a ten year

period. The data includes implementation and training costs, initial equipment costs, annual recurring costs and recurring savings. In addition a depreciation schedule based on the Sum-of-the-Years Digit method is provided. Two cash flow models follow to indicate the negative and positive cash flows that produce, first, the net cash flow before taxes and depreciation and, second, the net cash flow after taxes and depreciation. These net cash flows are subsequently discounted by year, using a ten percent discount factor (or interest rate). These two following models also indicate the manner of organizing the data for cost benefit analysis.

Figure D-1

Cash Flow Model Before Taxes & Depreciation

Period	Implementation & Training	Recurring Costs	Recurring Savings	Equipment Costs
1				
2	⊖	⊖	⊕	⊖
3	100%	100%	100%	100%
4				
5				
6				
7				
8				
9				
10				

Figure D-2

Cash Flow Model After Taxes & Depreciation

Period	Implementation & Training	Recurring Costs	Recurring Savings	Equipment	Depreciation	Investment Tax Credit
1						
2	⊖	⊖	⊕	⊖	⊕	⊕
3	52%	52%	52%	100%	48%	100%
4						
5						
6						
7						
8						
9						
10						

The Cash Flow Model Before Taxes and Depreciation is self-explanatory. All relevant costs and savings enter the cash flow at 100%. Depreciation does not appear since its only relevance to cash flow is due to tax effects. This model may be more relevant to investment analysis by government agencies.

The Cash Flow Model After Taxes and Depreciation is based on the impact of the standard 48% corporate income tax rate on all of the cash flows, both positive and negative. All implementation and training costs, recurring costs and recurring savings produce only a 52% cash flow due to the corporate tax. Equipment is a 100% negative cash flow partially recaptured by the Depreciation Tax Allowance (a 48% factor). The Investment Tax Credit is a one-time credit of seven percent (7%) to be taken fully (100%) in the year of purchase. The Cash Flow Model After Taxes and Depreciation produces an analysis realistically portraying corporate cash flows and therefore an analysis more compatible with corporate objectives than a before tax type of analysis.

Depreciation Methodology

Under the Sum-of-the-Years-Digit method changing fractions are applied each year to the original cost or other basis, less salvage. The numerator of the fraction each year represents the remaining useful life of the asset, and the denominator, which remains constant, is the sum of the numerals, representing each of the years of the estimated useful life (the Sum-of-the-Years-Digits).

This method is depicted by the following algorithm:

$$D_t = \frac{n-t+1}{\sum_{i=1}^{n} k_i} \quad (P)$$

where D_t is depreciation allowance for the year t

$\sum_{i=1}^{n} k_i$ is the Sum-of-the-Years-Digits.

P = Investment Cost
n - Number of Years of Life
t = Time Period (year) in which depreciated

and $\sum_{r=1}^{n} D_t = P$

For example, a ten year depreciation of a capital asset, P, would develop the following depreciation factors for each year t.

Table D-1

t	Depreciation Factor for Year t	
	Fractional	Decimal
1	10/55	0.181818
2	9/55	0.163636
3	8/55	0.145454
4	7/55	0.127272
5	6/55	0.109091
6	5/55	0.090909
7	4/55	0.072727
8	3/55	0.054545
9	2/55	0.036364
10	1/55	0.018182

The following table from 1976 U.S. Master Tax Guide, published by Commerce Clearing House, Inc., shows the effects of the three alternate methods on depreciation of an asset acquired for $100,000. The Sum-of-the-Years'-Digits method is used in this study.

Example: Assume that a newly acquired asset with a depreciable basis of $100,000 has an estimated useful life of 10 years and a negligible salvage value. The following table shows the annual depreciation allowances, and the accumulated depreciation under the 10% straight-line rate, the 200% declining-balance rate, and the sum of the years-digits method (see ¶ 1158), so you can compare results under each:

	Straight-line 10%		200% declining-balance 20%		Sum-of-the-years-digits	
Year	Annual charge	Cumulative	Annual charge	Cumulative	Annual charge	Cumulative
1	$10,000	$ 10,000	$20,000	$20,000	$18,182	$ 18,182
2	10,000	20,000	16,000	36,000	16,364	34,546
3	10,000	30,000	12,800	48,800	14,545	49,091
4	10,000	40,000	10,240	59,040	12,727	61,818
5	10,000	50,000	8,192	67,232	10,909	72,727
6	10,000	60,000	6,554	73,786	9,091	81,818
7	10,000	70,000	5,243	79,029	7,273	89,091
8	10,000	80,000	4,194	83,223	5,455	94,546
9	10,000	90,000	3,355	86,578	3,636	98,182
10	10,000	100,000	2,684	89,262	1,818	100,000

Data Elements

DVMP - Dollar Value of Machined Parts (Annual)
DVWIPI - Dollar Value of Work-in-process Inventory
APCPP - Annual Proportional Costs of Process Planning
APCT - Annual Proportional Costs of Tooling
APCDL - Annual Proportional Costs of Direct Labor
APCM - Annual Proportional Costs of Material
APCSR - Annual Proportional Costs of Scrap and Rework
APCOHP - Annual Proportional Costs of Overhead and Profit
IMPH - Implementation Costs - Hardware
IMPDF - Implementation Costs - Inital Data Files
IMPTP - Implementation Costs - Training of Personnel
IMPST - Implementation Costs - System Test
RCCPM - Annual Recurring Costs - Computer Charges and Program Maintenance
RCUDF - Annual Recurring Costs - Updating Data Files
PPI - Percent of Parts Impacted by Dollar Value
PDRSPP - Proportional Distribution of Recurring Savings - Planning Process
PDRST - Proportional Distribution of Recurring Savings - Tooling
PDRSDL - Proportional Distribution of Recurring Savings - Direct Labor
PDRSM - Proportional Distribution of Recurring Savings - Material
PDRSSR - Proportional Distribution of Recurring Savings - Scrap and Rework
PDRSWP - Proportional Distribution of Recurring Savings - Work-in-Process Inventory
DEPSCH - Depreciation Schedule based on Sum-of-the-Years-Digit Method.

The above data elements represent the data that was key punched for computer analysis. Where applicable separate data for each year of the system life was recorded and key punched. Separate decks were prepared for cylindrical and non-cylindrical parts and for composites of corporations responding to the Process Planning Survey. The manual recording and summarizing of survey results facilitated the preparation of the input decks for

SENSITIVITY ANALYSIS FOR CASE NUMBER 1 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 10.69
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 196.1

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-1.06	0.06	-15.23
	10%	1.06	-0.05	14.92
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.43	0.02	-6.03
	10%	0.43	-0.02	6.03
PERCENT TOOLING SAVINGS	-10%	-0.07	0.00	-0.95
	10%	0.07	-0.00	0.95
PERCENT LABOR SAVINGS	-10%	-0.27	0.01	-3.81
	10%	0.27	-0.01	3.81
PERCENT MATERIAL SAVINGS	-10%	-0.13	0.01	-1.90
	10%	0.13	-0.01	1.90
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.32
	10%	0.03	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	1.90
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.42	-0.05	14.60
	10%	-0.39	0.03	-12.38
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.70	-0.01	1.59
	10%	-0.62	0.01	-1.59
VALUE OF MACHINED PARTS	-10%	-0.92	0.05	-13.33
	10%	0.92	-0.04	13.01
VALUE OF WIPI	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	1.90
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.38	0.02	-5.40
	10%	0.33	-0.02	5.40
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.10	-0.01	1.59
	10%	-0.10	0.01	-1.59
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.01	-0.00	0.00
	10%	-0.01	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.40	-0.02	5.71
	10%	-0.40	0.02	-5.71

YEARLY CASH FLOW FOR CASE NUMBER 1 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	40.	39.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.	3.	-79.	-54.	-51.
2	0.	0.	7.	10.	13.	7.	12.	31.	8.	32.	16.	4.	16.	7.	0.	89.	50.	-3.
3	0.	0.	0.	0.	26.	13.	32.	135.	21.	85.	42.	10.	43.	6.	0.	297.	157.	115.
4	0.	0.	0.	0.	26.	13.	56.	237.	37.	148.	73.	17.	76.	5.	0.	549.	288.	322.
5	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	4.	0.	831.	419.	594.
6	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	4.	0.	801.	418.	842.
7	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	3.	0.	801.	418.	1067.
8	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	2.	0.	801.	417.	1271.
9	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	1.	0.	801.	417.	1458.
10	0.	0.	0.	0.	26.	13.	80.	339.	53.	212.	104.	24.	108.	1.	0.	801.	417.	1625.
TOTALS	40.	39.	7.	10.	221.	110.		2433.	384.	1535.	756.	176.	783.	40.	3.	5661.	2947.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 10.69
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 196.1

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 11.89
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 230.7

INPUT DATA FOR CASE NUMBER 1

COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 1

ANNUAL VALUE OF PARTS ($K) = 18900.0

ANNUAL VALUE OF WIP1 ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 23.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 20.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 4.0%	WIP1	= 3.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	13.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
UPDATE DATA FILES ($K)	0.0	6.5	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	32.0	56.0	80.0	80.0	80.0	80.0	80.0	80.0

APPENDIX E

RESULTS OF COST BENEFIT ANALYSES

The results of the cost benefit analyses for each of the 36 cases described in the main body of the report are contained in this appendix.

Each case encompasses a 3-page set of computer printouts: 1) the input data; 2) the cash flows by year, and 3) the sensitivity analysis.

In the sensitivity analysis all three of the figures of merit are recomputed for a 10% annual discount factor after taxes and depreciation. Thus, the net effects on the Benefit-to-Cost Ratio, the Years to Pay back, and the Return On Investment are given for each variation in each of the above input parameters.

Since the original proportional costs were stated as proportional parts of total costs, each plus or minus (10%) variation of any one of these input parameters is considered to cause a proportional redistribution of these related costs prior to computation of the net charges to the figures of merit.

IV - Sensitivity Analysis

In order to determine the sensitivity of the significant parameters of the cost benefit analysis for each scenario each of the following seventeen parameters were varied $\pm$ 10% and the net effects on each of the figures of merit were recorded for each such variation. The parameters undergoing sensitivity analysis include:

- Percent Parts Impacted
- Percent Process Planning Savings
- Percent Tooling Savings
- Percent Labor Savings
- Percent Material Savings
- Percent Scrap and Rework Savings
- Percent WIPI Savings
- Implementation Costs, including hardware, establishment of data files, testing and training
- Recurring Computer Charges, Program Maintenance and Updating Data files
- Value of Machined Parts
- Value of WIPI
- Original Percent Process Planning Costs
- Original Percent Tooling Costs
- Original Percent Labor Costs
- Original Percent Material Costs
- Original Percent Scrap and Rework Costs
- Original 'Other", including overhead, profit, etc.

where DCF represents the net cash flow occurring in the nth year.

Solving the R directly is unfeasible except when there is a single cash out flow followed by a series of uniform cash inflows over the remainder of the project life. In this special case, the ROI can be found by using the formula for the capital recovery factor. However, the use of a computer facilitates the use of an iterative method to calculate the DCF.

IITRI programmed an iterative search algorithm to find R, such that

$$0.999 \leq B\ C\ R \leq 1.001$$

where BCR = Benefit Cost Ratio. Use of this routine produced an ROI giving the BCR within the above limits after about ten iterations. All return on investment figures reported in the analyses of study data were calculated using this DCF approach. Figure D-3 portrays a graphical solution to the DCF problem.

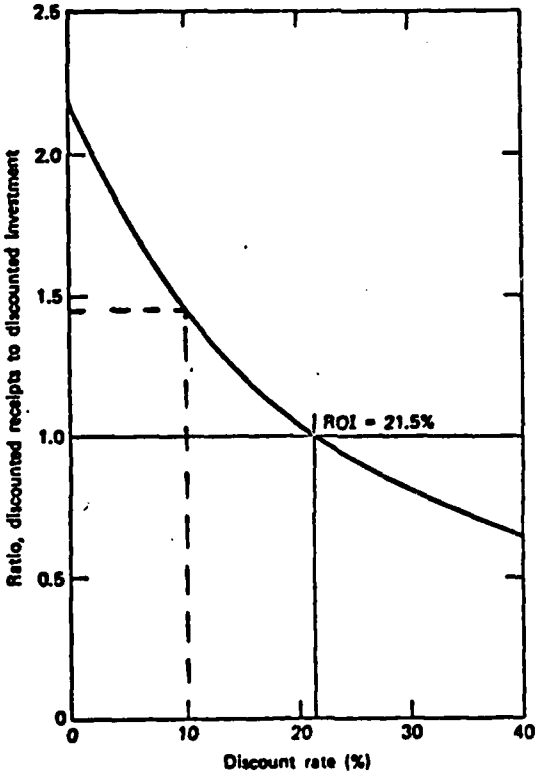


Figure D-3. Graphical Solution of DCF Problem

III - Return On Investment

All investments are ultimately evaluated by their rate of return. The rate of return determines the worthiness of the project on an economic basis. It determines whether a project is a likely prospect regardless of whether borrowed funds or internal funds are to be employed to finance the project. There are alternative ways to compute return on investment (ROI). but only the discounted cash flow (DCF) approach is compatible with the present value analysis applied to the data of this study. It is the only valid measure of ROI since it considers both the amount and timing of all cash inflows and outflows.

The DCF approach is a special case of the present worth method in which the sum of the present worths of all cash flows - both in and out - is set equal to zero. Whatever discount rate when applied to the cash flows makes their discounted values total zero is defined as the DCF rate of return. This ROI is also known as the internal rate of return or profitability index.

In DCF analysis a project's net cash flow is estimated for each year of its projected economic life. These cash flows are then discounted at an interest rate calculated to make the sum of discounted cash inflows equal to the sum of discounted cash out flows. The complexity of most DCF problems precludes any direct mathematical solution. The general form of a DCF problem can be expressed as follows:

$$NCF_o + \frac{NCF_1}{(1+R)} + \frac{NCF_2}{(1+R)^2} + \frac{NCF_3}{(1+R)^3} + \text{---} + \frac{NCF_n}{(1-R)^n} = 0$$

II - Years To Pay back

The pay out period is provided in the analysis package as one of three figures of merit. It is a simple and readily understood concept and has value for this reason alone. It has importance as a screening criterion; however, as a measure of investment desirability, pay back has three important shortcomings:

a) It overemphasizes the importance of early cash returns in the capital expenditure program

b) It ignores the project's economic life

c) It fails to consider project earnings after the initial investment has been recovered.

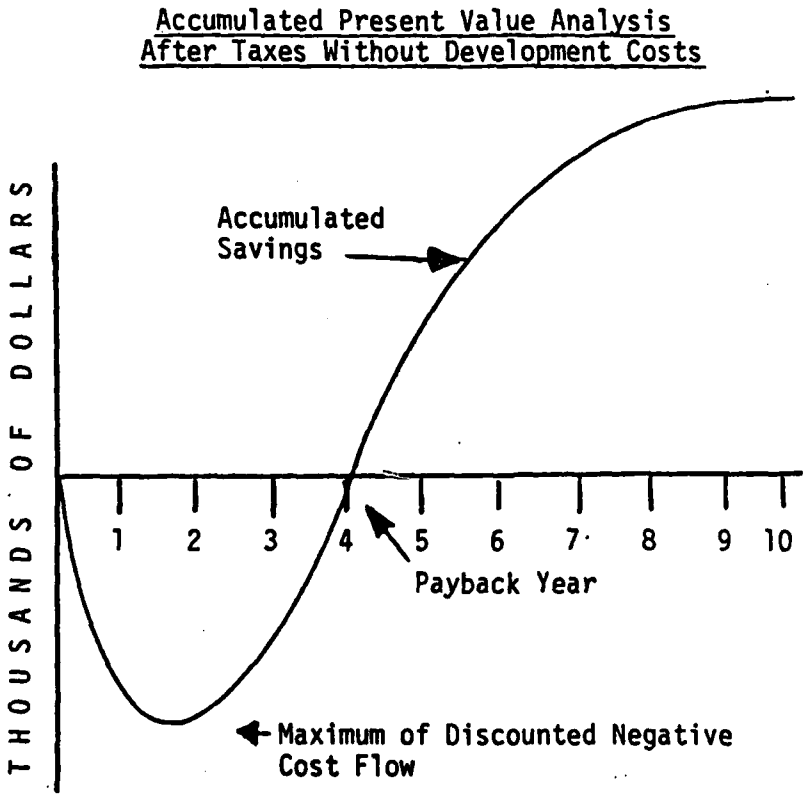
In all of the analyses involved in this study of process planning, the discounted cash flows are the basis of the pay back period. Use of discounting tends to lengthen the pay back period, but also keeps the pay back calculation compatible with the Benefit/Cost Ratio and the ROI (return on investment) calculations in this study.

The computational algorithm searches for the first year of positive cumulative present value and the linearly interpolates between the last negative value and the first positive value for Years to Pay back in years and tenths.

Cost Benefit Charts

Cost benefit charts are graphic tools to illustrate the effects of the cumulative cash flows over the life of a project. The point at which the accumulated costs and savings return to zero indicate the pay back year. The steepest negative point of the curve indicates the maximum discounted investment made in the project while the height of the curve above the base line indicates the discounted accumulated savings for the later years of the project after the repayment of the discounted costs.

Figure D-3



Benefit/Cost Ratio Before Taxes and Depreciation

$$BCRBT = \sum_{i=1}^{10} \frac{1}{(1+r)^{i-\frac{1}{2}}} \left[\frac{RSPP_i + RST_i + RSDL_i + RSM_i + RSSR_i + RSWIPI_i}{IMPH_i + IMPDF_i + IMPTP_i + IMPST_i + RCCPM_i + RCUDF_i} \right]$$

Benefit/Cost Ratio After Taxes and Depreciation

$$BCRAT = \sum_{i=1}^{10} \frac{1}{(1+r)^{i-\frac{1}{2}}} \left[\frac{\frac{52}{100}\left(RSPP_i + RST_i + RSDL_i + RSM_i + RSSR_i + RSWIPI_i\right) + \frac{48}{100} D_i + ITC_i}{\frac{52}{100}\left(IMPDF_i + IMPTP_i + IMPST_i + RCCPM_i + RCUDF_i\right) + IMPH_i} \right]$$

where i = years subsequent to implementation

and r = the discount rate to be applied (10%)

Cumulative Present Value For After Tax Calculations

$$CPV_i = \frac{1}{(1+r)^{i-\frac{1}{2}}} * YCFAT_i + YCFAT_{i-1}, \text{ for each year } i$$

or

Cumulative Present Value For Before Tax Calculations

$$CPV_i = \frac{1}{(1+r)^{i-\frac{1}{2}}} * YCFBT_i + YCFBT_{i-1}, \text{ for each year } i$$

depending on whether you are discounting cash flows before or after taxes.

Benefit/Cost Ratio

The benefit/cost ratio for the service life of the project is the ratio of the sum of the discounted benefits to the sum of the discounted costs. The computational algorithms for this ratio follows on the next page.

Recurring Savings - Work-in-process Inventory

$$RSWIPI_i = DVWIPI * \frac{PPI_i}{100} * \frac{PDRSWP}{100} * \frac{30}{100}, \text{ for each year } i.$$

If equipment or hardware is purchased in two or more years, then each purchase will have to be depreciated separately and then the depreciation allowance summed for each year. The algorithm for the calculation of depreciation follows:

Depreciation

$$D_i = \sum_{j=0}^{i-1} (IMPH_{j+1} * DEPSCH_{i-j}), \text{ for each year } i$$

for example:

for $i = 1$, $D_i = IMPH_1 * DEPSCH_1$

for $i = 2$, $D_i = IMPH_1 * DEPSCH_2 + IMPH_2 * DEPSCH_1$

for $i = 3$, $D_i = IMPH_1 * DEPSCH_3 + IMPH_2 * DEPSCH_2 + IMPH_3 * DEPSCH_1$

Investment Tax Credit

$$ITC_i = IMPH_i * \frac{7}{100}, \text{ for each year } i$$

Yearly Cash Flow Before Taxes and Depreciation

$$YCFBT_i = RSPP_i + RST_i + RSDL_i + RSM_i + RSSR_i + RSWIPI_i - IMPH_i - IMPDF_i - IMPTP_i - IMPST_i - RCCPM_i - RCUDF_i, \text{ for each year } i$$

Yearly Cash Flow After Taxes and Depreciation

$$YCFAT_i = \frac{52}{100}(RSPP_i + RST_i + RSDL_i + RSM_i + RSSR_i + RSWIPI_i - IMPDF_i - IMPTP_i - IMPST_i - RCCPM_i - RCUDF_i) + \frac{48}{100} * D_i + ITC_i - IMPH_i, \text{ for each year } i$$

computer analysis. Only eleven data cards were required for any individual run for cost benefit analysis.

Computational Methodology and Formulae

Implementation costs, including hardware, the establishment of the data files, the costs of personnel training and system testing were recorded directly from the input cards. The recurring costs, including computer and program maintenance costs and the cost of updating the files were recorded from the input cards. The PPI, percentage of parts impacted, was also recorded directly from the input cards. The recurring savings each required a computational algorithm which follows:

Recurring Savings - Process Planning

$$RSPP_i = DVMP * APCPP * \frac{PPI_i}{100} * \frac{PDRSPP}{100}, \text{ for each year i,}$$

where i = The year number since the start of implementation.

Recurring Savings - Tooling

$$RST_i = DVMP * APCT * \frac{PPI_i}{100} * \frac{PDRST}{100}, \text{ for each year i}$$

Recurring Savings - Direct Labor

$$RSDL_i = DVMP * APCDL * \frac{PPI_i}{100} * \frac{PDRSDL}{100}, \text{ for each year i}$$

Recurring Savings - Material

$$RSM_i = DVMP * APCM * \frac{PPI_i}{100} * \frac{PDRSM}{100}, \text{ for each year i}$$

Recurring Savings - Scrap and Rework

$$RSSR_i = DVMP * APCSR * \frac{PPI_i}{100} * \frac{PDRSSR}{100}, \text{ for each year i}$$

INPUT DATA FOR CASE NUMBER 2 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 18900.0 ANNUAL VALUE OF WIPI ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 23.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 39.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	117.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	119.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	15.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
UPDATE DATA FILES ($K)	0.0	13.5	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	32.0	56.0	80.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 2 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIPI SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	117.	119.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	21.	8.	-236.	-160.	-153.
2	0.	0.	11.	18.	15.	13.	12.	71.	11.	44.	16.	5.	32.	19.	0.	122.	73.	-90.
3	0.	0.	0.	0.	30.	27.	32.	189.	30.	119.	42.	15.	86.	17.	0.	423.	228.	90.
4	0.	0.	0.	0.	30.	27.	56.	330.	52.	207.	73.	25.	151.	15.	0.	702.	414.	385.
5	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	13.	0.	1142.	600.	777.
6	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	11.	0.	1142.	599.	1131.
7	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	9.	0.	1142.	598.	1453.
8	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	6.	0.	1142.	597.	1745.
9	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	4.	0.	1142.	596.	2010.
10	0.	0.	0.	0.	30.	27.	80.	472.	74.	296.	104.	36.	216.	2.	0.	1142.	595.	2251.
TOTALS	117.	119.	11.	18.	255.	229.		3420.	537.	2149.	756.	263.	1566.	117.	8.	7942.	4138.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.75
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 122.5

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.05
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 141.4

SENSITIVITY ANALYSIS FOR CASE NUMBER 2 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 2
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.75
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 123.5

	CHANGE	.. NET CHANGES IN ... BCR	VTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.76	0.11	-9.03
	10%	0.76	-0.09	8.57
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.30	0.04	-3.49
	10%	0.30	-0.04	3.49
PERCENT TOOLING SAVINGS	-10%	-0.05	0.01	-0.63
	10%	0.05	-0.01	0.40
PERCENT LABOR SAVINGS	-10%	-0.19	0.03	-2.22
	10%	0.19	-0.02	2.22
PERCENT MATERIAL SAVINGS	-10%	-0.07	0.01	-0.79
	10%	0.07	-0.01	0.63
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.32
	10%	0.02	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.14	0.02	-1.59
	10%	0.14	-0.02	1.59
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.44	-0.09	8.37
	10%	-0.39	0.09	-7.46
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.36	-0.01	0.79
	10%	-0.34	0.01	-0.93
VALUE OF MACHINED PARTS	-10%	-0.62	0.09	-7.46
	10%	0.62	-0.08	7.14
VALUE OF WIPI	-10%	-0.14	0.02	-1.59
	10%	0.14	-0.02	1.59
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.27	0.04	-3.17
	10%	0.27	-0.03	3.17
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.00	-0.32
	10%	0.02	-0.00	0.16
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.10	-0.01	1.11
	10%	-0.10	0.01	-1.27
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.27	-0.03	3.02
	10%	-0.27	0.04	-3.17

INPUT DATA FOR CASE NUMBER 3

COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 3

ANNUAL VALUE OF PARTS ($K) = 18900.0

ANNUAL VALUE OF WIP ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%
DIRECT LABOR	= 20.0%
SCRAP & REWORK	= 4.0%
TOOLING	= 7.0%
MATERIAL	= 23.0%
OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 50.0%
DIRECT LABOR	= 10.0%
SCRAP & REWORK	= 10.0%
TOOLING	= 12.0%
MATERIAL	= 4.0%
WIP	= 6.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	224.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	137.0	137.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	29.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0
UPDATE DATA FILES ($K)	0.0	23.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	32.0	56.0	80.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 3 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIFI SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	224.	157.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	41.	16.	-381.	-270.	-250.
2	0.	157.	19.	34.	29.	23.	12.	103.	19.	64.	21.	9.	49.	37.	0.	4.	20.	-241.
3	0.	0.	0.	0.	57.	46.	32.	201.	51.	169.	56.	24.	133.	33.	0.	607.	331.	21.
4	0.	0.	0.	0.	57.	46.	56.	491.	89.	296.	97.	42.	227.	29.	0.	1140.	606.	433.
5	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	24.	0.	1673.	881.	1029.
6	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	20.	0.	1673.	879.	1559.
7	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	16.	0.	1673.	878.	2022.
8	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	12.	0.	1673.	876.	2450.
9	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	8.	0.	1673.	874.	2839.
10	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	4.	0.	1673.	872.	3191.
TOTALS	224.	314.	19.	34.	485.	391.		5086.	921.	3069.	1009.	438.	2349.	224.	16.	11406.	5947.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.86
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 101.4

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.77
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 117.1

SENSITIVITY ANALYSIS FOR CASE NUMBER 3 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 3
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.06
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 101.4

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	*****	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.37	0.13	-7.79
	10%	0.37	-0.13	7.62
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.23	0.06	-3.02
	10%	0.23	-0.06	3.02
PERCENT TOOLING SAVINGS	-10%	-0.04	0.01	-0.48
	10%	0.04	-0.01	0.63
PERCENT LABOR SAVINGS	-10%	-0.14	0.04	-1.90
	10%	0.14	-0.03	1.90
PERCENT MATERIAL SAVINGS	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.63
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.10	0.03	-1.43
	10%	0.10	-0.03	1.43
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.33	-0.13	7.46
	10%	-0.31	0.11	-6.33
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.23	-0.02	0.93
	10%	-0.23	0.02	-0.79
VALUE OF MACHINED PARTS	-10%	-0.47	0.11	-6.35
	10%	0.47	-0.11	6.19
VALUE OF WIPI	-10%	-0.10	0.03	-1.43
	10%	0.10	-0.03	1.43
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.20	0.06	-2.70
	10%	0.20	-0.05	2.70
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.08	-0.02	1.11
	10%	-0.08	0.02	-1.11
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.20	-0.05	2.70
	10%	-0.20	0.05	-2.70

INPUT DATA FOR CASE NUMBER 4 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 1

****

ANNUAL VALUE OF PARTS ($K) = 14300.0 ANNUAL VALUE OF WIP1 ($K) = 15300.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 28.0%	MATERIAL	= 24.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 29.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 26.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 4.0%	WIP1	= 3.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	496.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	26.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0	52.0
UPDATE DATA FILES ($K)	0.0	7.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	13.0	35.0	61.0	80.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 4 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	30.	496.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.	3.	-534.	-290.	-270.
2	0.	0.	0.	10.	26.	7.	13.	39.	7.	26.	13.	3.	18.	6.	0.	54.	31.	-250.
3	0.	0.	0.	0.	52.	15.	35.	104.	18.	70.	36.	8.	48.	6.	0.	217.	115.	-159.
4	0.	0.	0.	0.	52.	15.	61.	181.	31.	122.	63.	14.	84.	5.	0.	420.	225.	2.
5	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	4.	0.	582.	305.	201.
6	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	3.	0.	582.	304.	381.
7	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	3.	0.	582.	304.	543.
8	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	2.	0.	582.	304.	693.
9	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	1.	0.	582.	303.	828.
10	0.	0.	0.	0.	52.	15.	80.	238.	40.	160.	82.	18.	110.	1.	0.	582.	303.	951.
TOTALS	30.	496.	0.	10.	442.	127.		1762.	295.	1179.	606.	135.	811.	38.	3.	3657.	1904.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.04
YEARS TO PAYBACK = 4.0
RETURN ON INVESTMENT = 51.7

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.12
YEARS TO PAYBACK = 4.0
RETURN ON INVESTMENT = 52.7

SENSITIVITY ANALYSIS FOR CASE NUMBER 4 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 1
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.04
YEARS TO PAYBACK = 4.0
RETURN ON INVESTMENT = 51.7

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.30	0.20	-4.76
	10%	0.30	-0.19	4.44
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.11	0.07	-1.75
	10%	0.11	-0.08	1.59
PERCENT TOOLING SAVINGS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.24
PERCENT LABOR SAVINGS	-10%	-0.07	0.05	-1.19
	10%	0.07	-0.05	1.11
PERCENT MATERIAL SAVINGS	-10%	-0.04	0.03	-0.63
	10%	0.04	-0.03	0.56
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.08
PERCENT WIPI SAVINGS	-10%	-0.05	0.03	-0.79
	10%	0.05	-0.04	0.71
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.20	-0.17	4.13
	10%	-0.17	0.14	-3.65
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.12	-0.04	0.63
	10%	-0.11	0.04	-0.79
VALUE OF MACHINED PARTS	-10%	-0.25	0.16	-3.89
	10%	0.25	-0.16	3.65
VALUE OF WIPI	-10%	-0.05	0.03	-0.79
	10%	0.05	-0.04	0.71
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.10	0.06	-1.51
	10%	0.10	-0.07	1.43
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	-0.08
	10%	0.00	-0.00	0.00
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.08
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.03	-0.02	0.40
	10%	-0.03	0.02	-0.48
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	-0.08
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.10	-0.07	1.51
	10%	-0.10	0.06	-1.59

INPUT DATA FOR CASE NUMBER 5 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 14300.0 ANNUAL VALUE OF WIP ($K) = 15300.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 28.0%	MATERIAL	= 24.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 29.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 39.0%	TOOLING	= 7.0%
DIRECT LABOR	= 6.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	91.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
UPDATE DATA FILES ($K)	0.0	8.5	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	13.0	35.0	61.0	80.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 5 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	91.	88.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	17.	6.	-179.	-122.	-117.
2	0.	0.	10.	18.	18.	8.	13.	58.	9.	31.	13.	4.	24.	15.	0.	86.	52.	-73.
3	0.	0.	0.	0.	36.	17.	35.	156.	23.	84.	36.	12.	64.	13.	0.	324.	175.	66.
4	0.	0.	0.	0.	36.	17.	61.	272.	43.	147.	63.	21.	113.	12.	0.	604.	320.	295.
5	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	10.	0.	809.	425.	572.
6	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	8.	0.	809.	425.	823.
7	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	7.	0.	809.	424.	1051.
8	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	5.	0.	809.	423.	1258.
9	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	3.	0.	809.	422.	1446.
10	0.	0.	0.	0.	36.	17.	80.	357.	56.	192.	82.	27.	147.	2.	0.	809.	421.	1616.
TOTALS	91.	88.	10.	18.	306.	144.		2628.	413.	1415.	606.	202.	1081.	91.	6.	5608.	2964.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.72
YEARS TO PAYBACK = 2.8
RETURN ON INVESTMENT = 120.1

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.73
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 139.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 5 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 2
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.72
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 120.1

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.66	0.12	-9.20
	10%	0.66	-0.09	8.89
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.27	0.05	-3.81
	10%	0.27	-0.04	3.65
PERCENT TOOLING SAVINGS	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.48
PERCENT LABOR SAVINGS	-10%	-0.15	0.02	-2.06
	10%	0.15	-0.02	2.06
PERCENT MATERIAL SAVINGS	-10%	-0.06	0.01	-0.79
	10%	0.06	-0.01	0.79
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.32
	10%	0.02	-0.00	0.32
PERCENT WIP1 SAVINGS	-10%	-0.11	0.02	-1.59
	10%	0.11	-0.02	1.43
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.34	-0.09	8.73
	10%	-0.31	0.09	-7.30
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.33	-0.02	1.11
	10%	-0.32	0.02	-1.11
VALUE OF MACHINED PARTS	-10%	-0.53	0.10	-7.62
	10%	0.53	-0.08	7.46
VALUE OF WIP1	-10%	-0.11	0.02	-1.59
	10%	0.11	-0.02	1.43
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.25	0.04	-3.49
	10%	0.23	-0.04	3.33
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	-0.16
	10%	0.00	-0.00	0.00
ORIGINAL PERCENT LABOR COSTS	-10%	0.01	-0.00	0.16
	10%	-0.01	0.00	-0.16
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.09	-0.01	1.11
	10%	-0.09	0.01	-1.27
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.22	-0.03	3.02
	10%	-0.22	0.04	-3.02

INPUT DATA FOR CASE NUMBER 6 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 3

****

ANNUAL VALUE OF PARTS ($K) = 14300.0 ANNUAL VALUE OF WIPI ($K) = 15300.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 28.0%	MATERIAL	= 24.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 29.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 56.0%	TOOLING	= 12.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 4.0%
SCRAP & REWORK	= 10.0%	WIPI	= 7.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	174.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	102.0	102.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	42.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0
UPDATE DATA FILES ($K)	0.0	19.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	13.0	35.0	61.0	80.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 6 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	174.	102.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	32.	12.	-276.	-200	-190.
2	0.	102.	22.	38.	42.	19.	13.	83.	16.	52.	18.	7.	42.	28.	0.	-5.	11.	-181.
3	0.	0.	0.	0.	83.	38.	33.	224.	42.	140.	48.	20.	112.	23.	0.	466.	254.	29.
4	0.	0.	0.	0.	83.	38.	61.	391.	73.	244.	84.	35.	196.	22.	0.	902.	480.	363.
5	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	19.	0.	1221.	644.	783.
6	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	16.	0.	1221.	642.	1163.
7	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	13.	0.	1221.	641.	1503.
8	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	9.	0.	1221.	639.	1820.
9	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	6.	0.	1221.	638.	2104.
10	0.	0.	0.	0.	83.	38.	80.	513.	96.	320.	110.	46.	257.	3.	0.	1221.	636.	2361.
TOTALS	174.	204.	22.	38.	706.	323.		3773.	708.	2358.	809.	337.	1892.	174.	12.	8410.	4385.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.88
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 102.5

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.48
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 119.3

INPUT DATA FOR CASE NUMBER 11 — MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 10000.0

ANNUAL VALUE OF WIP1 ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 6.0%	TOOLING	= 9.0%
DIRECT LABOR	= 22.0%	MATERIAL	= 10.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP1	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
UPDATE DATA FILES ($K)	0.0	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	60.0	60.0	60.0	60.0	60.0	60.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 10 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.51
YEARS TO PAYBACK = 2.8
RETURN ON INVESTMENT = 109.2

	CHANGE	.. NET CHANGES IN ... BCR	VTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.45	0.20	-9.84
	10%	0.43	-0.16	9.52
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.18	0.07	-3.81
	10%	0.18	-0.07	3.31
PERCENT TOOLING SAVINGS	-10%	-0.05	0.02	-1.11
	10%	0.05	-0.02	1.11
PERCENT LABOR SAVINGS	-10%	-0.13	0.05	-2.86
	10%	0.13	-0.05	2.86
PERCENT MATERIAL SAVINGS	-10%	-0.04	0.01	-0.79
	10%	0.04	-0.01	0.79
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.04	0.02	-0.95
	10%	0.04	-0.02	0.95
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.10	-0.08	5.07
	10%	-0.09	0.08	-5.08
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.39	-0.09	4.20
	10%	-0.33	0.10	-4.19
VALUE OF MACHINED PARTS	-10%	-0.41	0.18	-8.89
	10%	0.41	-0.14	8.73
VALUE OF WIPI	-10%	-0.04	0.02	-0.95
	10%	0.04	-0.02	0.95
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.16	0.07	-3.49
	10%	0.16	-0.06	3.49
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.05	0.02	-1.11
	10%	0.05	-0.02	1.11
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.00	0.16
	10%	-0.01	0.00	-0.16
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.41	-0.14	8.73
	10%	-0.41	0.18	-8.89

YEARLY CASH FLOW FOR CASE NUMBER 10

MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	30.	3.	10.	9.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-52.	-27.	-26.
2	0.	0.	3.	0.	18.	10.	10.	15.	5.	11.	3.	1.	4.	0.	0.	7.	4.	-23.
3	0.	0.	0.	0.	18.	10.	25.	37.	11.	27.	7.	2.	9.	0.	0.	67.	35.	5.
4	0.	0.	0.	0.	18.	10.	40.	60.	18.	44.	12.	4.	14.	0.	0.	124.	64.	51.
5	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	119.
6	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	183.
7	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	235.
8	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	287.
9	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	331.
10	0.	0.	0.	0.	18.	10.	60.	90.	27.	66.	18.	5.	22.	0.	0.	200.	104.	373.
TOTALS	0.	30.	6.	10.	171.	90.		652.	196.	470.	130.	39.	157.	0.	0.	1346.	700.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.51
YEARS TO PAYBACK = 2.8
RETURN ON INVESTMENT = 109.2

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.51
YEARS TO PAYBACK = 2.8
RETURN ON INVESTMENT = 109.2

INPUT DATA FOR CASE NUMBER 10 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 6.0%	TOOLING	= 9.0%
DIRECT LABOR	= 22.0%	MATERIAL	= 10.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIPI	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	9.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	60.0	60.0	60.0	60.0	60.0	60.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 9 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.71
YEARS TO PAYBACK = 3.5
RETURN ON INVESTMENT = 37.9

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.17	0.41	-5.63
	10%	0.17	-0.31	5.24
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.07	0.15	-2.22
	10%	0.07	-0.13	2.06
PERCENT TOOLING SAVINGS	-10%	-0.02	0.05	-0.79
	10%	0.02	-0.05	0.71
PERCENT LABOR SAVINGS	-10%	-0.04	0.10	-1.51
	10%	0.04	-0.09	1.43
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.32
	10%	0.01	-0.02	0.32
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.24
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.02	0.03	-0.56
	10%	0.02	-0.03	0.48
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.05	-0.14	2.54
	10%	-0.05	0.14	-2.38
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.13	-0.20	3.02
	10%	-0.11	0.22	-3.02
VALUE OF MACHINED PARTS	-10%	-0.13	0.36	-5.08
	10%	0.13	-0.28	4.76
VALUE OF WIPI	-10%	-0.02	0.03	-0.36
	10%	0.02	-0.03	0.40
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.06	0.14	-2.06
	10%	0.06	-0.12	1.90
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.03	-0.43
	10%	0.01	-0.03	0.40
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.04	-0.63
	10%	0.02	-0.04	0.48
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.03	0.48
	10%	-0.01	0.03	-0.48
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.16
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.13	-0.28	4.76
	10%	-0.13	0.36	-5.08

YEARLY CASH FLOW FOR CASE NUMBER 9 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	60.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-115.	-71.	-69.
2	10.	80.	20.	40.	90.	30.	5.	15.	5.	10.	2.	2.	4.	8.	1.	-293.	-121.	-173.
3	10.	60.	0.	20.	90.	60.	20.	60.	21.	40.	9.	6.	14.	9.	1.	-90.	-47.	-210.
4	0.	0.	0.	0.	90.	60.	35.	105.	37.	70.	16.	10.	25.	8.	0.	113.	62.	-165.
5	0.	0.	0.	0.	90.	60.	60.	180.	63.	120.	27.	18.	43.	7.	0.	301.	160.	-61.
6	0.	0.	0.	0.	90.	60.	70.	210.	73.	140.	31.	21.	50.	6.	0.	376.	198.	57.
7	0.	0.	0.	0.	90.	60.	70.	210.	73.	140.	31.	21.	50.	5.	0.	376.	198.	163.
8	0.	0.	0.	0.	90.	60.	70.	210.	73.	140.	31.	21.	50.	4.	0.	376.	197.	263.
9	0.	0.	0.	0.	90.	60.	70.	210.	73.	140.	31.	21.	50.	3.	0.	376.	197.	347.
10	0.	0.	0.	0.	90.	60.	70.	210.	73.	140.	31.	21.	50.	2.	0.	376.	196.	427.
TOTALS	55.	200.	40.	60.	810.	510.		1410.	493.	940.	211.	141.	338.	54.	4.	1859.	970.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.71
YEARS TO PAYBACK = 5.5
RETURN ON INVESTMENT = 37.9

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.74
YEARS TO PAYBACK = 5.5
RETURN ON INVESTMENT = 39.3

INPUT DATA FOR CASE NUMBER 9 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3
****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIP ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	60.0	80.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	40.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
UPDATE DATA FILES ($K)	0.0	30.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	70.0	70.0	70.0	70.0	70.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 8 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.41
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 62.8

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.23	0.22	-6.98
	10%	0.23	-0.18	6.82
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.09	0.08	-2.70
	10%	0.09	-0.07	2.70
PERCENT TOOLING SAVINGS	-10%	-0.02	0.02	-0.63
	10%	0.02	-0.02	0.63
PERCENT LABOR SAVINGS	-10%	-0.06	0.05	-1.90
	10%	0.06	-0.05	1.90
PERCENT MATERIAL SAVINGS	-10%	-0.02	0.02	-0.63
	10%	0.02	-0.02	0.63
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.03	0.03	-0.95
	10%	0.03	-0.03	0.95
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.07	-0.09	3.97
	10%	-0.06	0.09	-3.49
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.13	-0.10	3.17
	10%	-0.16	0.11	-3.17
VALUE OF MACHINED PARTS	-10%	-0.20	0.19	-6.03
	10%	0.20	-0.15	5.07
VALUE OF WIPI	-10%	-0.03	0.03	-0.95
	10%	0.03	-0.03	0.95
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.08	0.07	-2.54
	10%	0.08	-0.07	2.38
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.01	-0.24
	10%	0.01	-0.01	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.03	0.02	-0.79
	10%	0.03	-0.02	0.79
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.01	0.32
	10%	-0.01	0.01	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.20	-0.15	5.87
	10%	-0.20	0.19	-6.03

YEARLY CASH FLOW FOR CASE NUMBER 8 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	33.	30.	6.	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-81.	-53.	-51.
2	10.	30.	6.	10.	43.	18.	10.	20.	5.	14.	5.	2.	7.	8.	1.	-67.	-35.	-81.
3	10.	0.	0.	0.	43.	36.	25.	50.	12.	33.	11.	5.	18.	9.	1.	40.	21.	-65.
4	0.	0.	0.	0.	43.	36.	40.	80.	20.	56.	18.	7.	29.	8.	0.	129.	70.	-14.
5	0.	0.	0.	0.	43.	36.	65.	130.	32.	91.	29.	12.	47.	7.	0.	260.	138.	75.
6	0.	0.	0.	0.	43.	36.	70.	140.	34.	98.	31.	13.	50.	6.	0.	286.	151.	165.
7	0.	0.	0.	0.	43.	36.	70.	140.	34.	98.	31.	13.	50.	5.	0.	286.	151.	246.
8	0.	0.	0.	0.	43.	36.	70.	140.	34.	98.	31.	13.	50.	4.	0.	286.	150.	320.
9	0.	0.	0.	0.	43.	36.	70.	140.	34.	98.	31.	13.	50.	3.	0.	286.	150.	385.
10	0.	0.	0.	0.	43.	36.	70.	140.	34.	98.	31.	13.	50.	2.	0.	286.	149.	447.
TOTALS	33.	60.	12.	20.	403.	306.		980.	240.	686.	220.	88.	353.	54.	4.	1710.	892.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.41
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 62.8

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.33
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 68.7

INPUT DATA FOR CASE NUMBER 8 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
UPDATE DATA FILES ($K)	0.0	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	70.0	70.0	70.0	70.0	70.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 7 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.63
YEARS TO PAYBACK = 3.0
RETURN ON INVESTMENT = 104.7

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	*** ***	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.46	0.13	-9.20
	10%	0.46	-0.18	8.89
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.17	0.03	-3.17
	10%	0.17	-0.07	3.17
PERCENT TOOLING SAVINGS	-10%	-0.03	0.02	-0.79
	10%	0.03	-0.02	0.95
PERCENT LABOR SAVINGS	-10%	-0.13	0.04	-2.54
	10%	0.13	-0.06	2.54
PERCENT MATERIAL SAVINGS	-10%	-0.06	0.02	-1.11
	10%	0.06	-0.03	1.27
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.03	0.02	-0.95
	10%	0.03	-0.02	0.95
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.10	-0.09	3.40
	10%	-0.10	0.06	-4.76
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.40	-0.11	4.13
	10%	-0.34	0.08	-3.81
VALUE OF MACHINED PARTS	-10%	-0.41	0.13	-8.25
	10%	0.41	-0.17	8.09
VALUE OF WIPI	-10%	-0.03	0.02	-0.95
	10%	0.03	-0.02	0.95
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.15	0.05	-2.86
	10%	0.15	-0.07	3.02
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.06	0.02	-1.11
	10%	0.06	-0.03	1.27
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.00	-0.00	0.16
	10%	-0.00	0.00	0.00
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.41	-0.17	8.09
	10%	-0.41	0.13	-8.25

YEARLY CASH FLOW FOR CASE NUMBER 7 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	30.	3.	10.	9.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-52.	-27.	-26.
2	0.	0.	3.	0.	18.	10.	10.	12.	3.	10.	5.	1.	4.	0.	0.	4.	2.	-24.
3	0.	0.	0.	0.	18.	10.	25.	31.	9.	25.	11.	2.	9.	0.	0.	59.	31.	0.
4	0.	0.	0.	0.	18.	10.	40.	50.	14.	40.	18.	4.	14.	0.	0.	112.	58.	42.
5	0.	0.	0.	0.	18.	10.	65.	81.	23.	65.	29.	6.	23.	0.	0.	200.	104.	110.
6	0.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	176.
7	.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	237.
8	.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	293.
9	0.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	343.
10	0.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	388.
TOTALS	0.	30.	6.	10.	171.	90.		612.	171.	490.	220.	44.	176.	0.	0.	1408.	732.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.63
YEARS TO PAYBACK = 3.0
RETURN ON INVESTMENT = 104.7

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.63
YEARS TO PAYBACK = 3.0
RETURN ON INVESTMENT = 104.7

INPUT DATA FOR CASE NUMBER 7 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIPI	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0 0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	9.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	63.0	70.0	70.0	70.0	70.0	70.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 6 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 3
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.08
YEARS TO PAYBACK = 2.9
RETURN ON INVESTMENT = 102.5

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.43	0.14	-8.57
	10%	0.43	-0.14	8.23
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.18	0.06	-3.17
	10%	0.18	-0.06	3.17
PERCENT TOOLING SAVINGS	-10%	-0.03	0.01	-0.63
	10%	0.03	-0.01	0.63
PERCENT LABOR SAVINGS	-10%	-0.11	0.04	-2.06
	10%	0.11	-0.04	1.90
PERCENT MATERIAL SAVINGS	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.63
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.09	0.03	-1.59
	10%	0.09	-0.03	1.59
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.23	-0.12	7.62
	10%	-0.21	0.11	-6.51
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.27	-0.04	1.43
	10%	-0.24	0.04	-1.43
VALUE OF MACHINED PARTS	-10%	-0.39	0.12	-6.82
	10%	0.39	-0.12	6.67
VALUE OF WIPI	-10%	-0.09	0.03	-1.59
	10%	0.09	-0.03	1.59
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.16	0.06	-2.86
	10%	0.16	-0.05	2.86
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.07	-0.02	1.27
	10%	-0.07	0.02	-1.27
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.16	-0.05	2.70
	10%	-0.16	0.05	-2.86

YEARLY CASH FLOW FOR CASE NUMBER 11 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	40.	6.	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-91.	-59.	-56.
2	10.	40.	6.	10.	45.	18.	10.	24.	6.	15.	3.	2.	7.	8.	1.	-71.	-38.	-83.
3	10.	0.	0.	0.	45.	36.	25.	60.	16.	38.	7.	5.	18.	9.	1.	53.	28.	-67.
4	0.	0.	0.	0.	45.	36.	40.	96.	25.	62.	12.	7.	29.	8.	0.	150.	82.	-8.
5	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	7.	0.	265.	141.	81.
6	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	6.	0.	265.	141.	167.
7	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	5.	0.	265.	140.	242.
8	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	4.	0.	265.	140.	311.
9	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	3.	0.	265.	139.	372.
10	0.	0.	0.	0.	45.	36.	60.	144.	38.	92.	18.	11.	43.	2.	0.	265.	139.	428.
TOTALS	55.	80.	12.	20.	405.	306.		1044.	274.	670.	130.	78.	313.	54.	4.	1632.	852.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.31
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 61.1

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.43
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 66.6

SENSITIVITY ANALYSIS FOR CASE NUMBER 11 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.31
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 61.1

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.22	0.23	-7.14
	10%	0.22	-0.22	6.98
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.09	0.09	-2.86
	10%	0.09	-0.08	3.02
PERCENT TOOLING SAVINGS	-10%	-0.02	0.02	-0.63
	10%	0.02	-0.02	0.79
PERCENT LABOR SAVINGS	-10%	-0.06	0.05	-1.75
	10%	0.06	-0.05	1.90
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.01	-0.32
	10%	0.01	-0.01	0.48
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.03	0.03	-0.79
	10%	0.03	-0.02	0.95
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.07	-0.16	4.28
	10%	-0.06	0.09	-3.65
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.17	-0.11	3.17
	10%	-0.13	0.11	-3.02
VALUE OF MACHINED PARTS	-10%	-0.20	0.19	-6.19
	10%	0.20	-0.19	6.03
VALUE OF WIPI	-10%	-0.03	0.03	-0.79
	10%	0.03	-0.02	0.95
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.09	0.08	-2.70
	10%	0.09	-0.07	2.70
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.02	-0.63
	10%	0.02	-0.02	0.79
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.01	0.32
	10%	-0.01	0.01	-0.16
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.16
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.20	-0.19	6.03
	10%	-0.20	0.19	-6.19

INPUT DATA FOR CASE NUMBER 12 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 6.0%	TOOLING	= 9.0%
DIRECT LABOR	= 22.0%	MATERIAL	= 10.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	33.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	120.0	160.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	40.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
UPDATE DATA FILES ($K)	0.0	30.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	60.0	60.0	60.0	60.0	60.0

YEARLY CASH FLOW FOR CASE NUMBER 12 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	33.	120.	30.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-183.	-107.	-102.
2	10.	160.	30.	40.	90.	30.	5.	18.	7.	11.	2.	2.	4.	8.	1.	-318.	-166.	-246.
3	10.	120.	0.	20.	90.	60.	20.	72.	27.	44.	6.	6.	14.	9.	1.	-131.	-68.	-300.
4	0.	0.	0.	0.	90.	60.	33.	126.	47.	77.	10.	10.	23.	8.	0.	146.	80.	-242.
5	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	7.	0.	358.	189.	-119.
6	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	6.	0.	338.	189.	-7.
7	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	5.	0.	338.	188.	94.
8	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	4.	0.	338.	188.	186.
9	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	3.	0.	358.	187.	270.
10	0.	0.	0.	0.	90.	60.	60.	216.	81.	132.	18.	18.	43.	2.	0.	338.	187.	343.
TOTALS	53.	400.	60.	60.	810.	510.		1512.	567.	924.	126.	126.	302.	54.	4.	1662.	868.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.49
YEARS TO PAYBACK = 6.1
RETURN ON INVESTMENT = 20.8

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.51
YEARS TO PAYBACK = 6.1
RETURN ON INVESTMENT = 29.5

SENSITIVITY ANALYSIS FOR CASE NUMBER 12 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.49
YEARS TO PAYBACK = 6.1
RETURN ON INVESTMENT = 20.8

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.15	0.62	-5.00
	10%	0.15	-0.43	4.60
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.06	0.24	-2.06
	10%	0.06	-0.20	1.98
PERCENT TOOLING SAVINGS	-10%	-0.02	0.09	-0.79
	10%	0.02	-0.08	0.71
PERCENT LABOR SAVINGS	-10%	-0.04	0.14	-1.27
	10%	0.04	-0.13	1.19
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.24
	10%	0.01	-0.02	0.16
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.02	-0.24
	10%	0.01	-0.02	0.16
PERCENT WIPI SAVINGS	-10%	-0.01	0.03	-0.40
	10%	0.01	-0.04	0.40
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.06	-0.25	2.62
	10%	-0.06	0.26	-2.38
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.02	-0.24	2.30
	10%	-0.00	0.28	-2.30
VALUE OF MACHINED PARTS	-10%	-0.13	0.56	-4.32
	10%	0.13	-0.40	4.21
VALUE OF WIPI	-10%	-0.01	0.03	-0.40
	10%	0.01	-0.04	0.40
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.06	0.22	-1.90
	10%	0.06	-0.19	1.82
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.03	-0.40
	10%	0.01	-0.04	0.40
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.04	-0.40
	10%	0.01	-0.04	0.32
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.03	0.24
	10%	-0.01	0.03	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.13	-0.40	4.21
	10%	-0.13	0.56	-4.32

INPUT DATA FOR CASE NUMBER 13 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1
****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIP1 ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 25.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIP1	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
UPDATE DATA FILES ($K)	0.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 13 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	40.	6.	10.	18.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-74.	-38.	-37.
2	0.	0.	6.	0.	36.	20.	10.	37.	12.	62.	30.	3.	15.	0.	0.	98.	51.	6.
3	0.	0.	0.	0.	36.	20.	25.	94.	31.	156.	75.	7.	37.	0.	0.	345.	180.	149.
4	0.	0.	0.	0.	36.	20.	40.	150.	50.	250.	120.	12.	60.	0.	0.	586.	305.	367.
5	0.	0.	0.	0.	36.	20.	65.	244.	81.	406.	195.	19.	98.	0.	0.	937.	513.	703.
6	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	1129.
7	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	1518.
8	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	1871.
9	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	2192.
10	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	2484.
TOTALS	0.	40.	12.	10.	342.	180.		2212.	737.	3687.	1770.	177.	885.	0.	0.	8885.	4620.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.47
YEARS TO PAYBACK = 1.8
RETURN ON INVESTMENT = 263.7

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.47
YEARS TO PAYBACK = 1.8
RETURN ON INVESTMENT = 263.7

SENSITIVITY ANALYSIS FOR CASE NUMBER 13 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.47
YEARS TO PAYBACK = 1.8
RETURN ON INVESTMENT = 263.7

	CHANGE	.. NET CHANGES IN ... BCR	PTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-1.35	0.16	-22.83
	10%	1.35	-0.12	22.83
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.31	0.03	-5.40
	10%	0.31	-0.03	5.40
PERCENT TOOLING SAVINGS	-10%	-0.10	0.01	-1.90
	10%	0.10	-0.01	1.90
PERCENT LABOR SAVINGS	-10%	-0.52	0.06	-8.89
	10%	0.52	-0.05	8.89
PERCENT MATERIAL SAVINGS	-10%	-0.25	0.03	-4.44
	10%	0.25	-0.02	4.44
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.63
	10%	0.03	-0.00	0.63
PERCENT WIPI SAVINGS	-10%	-0.13	0.01	-1.90
	10%	0.13	-0.01	2.22
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.21	-0.07	14.60
	10%	-0.29	0.07	-12.70
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	1.23	-0.06	9.52
	10%	-1.05	0.07	-8.89
VALUE OF MACHINED PARTS	-10%	-1.22	0.14	-20.93
	10%	1.22	-0.11	20.63
VALUE OF WIPI	-10%	-0.13	0.01	-1.90
	10%	0.13	-0.01	2.22
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.29	0.03	-4.76
	10%	0.29	-0.03	5.08
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.05	0.00	-0.63
	10%	0.05	-0.00	0.63
ORIGINAL PERCENT LABOR COSTS	-10%	-0.29	0.03	-5.08
	10%	0.29	-0.03	5.08
ORIGINAL PERCENT MATERIAL COSTS	-10%	-0.01	0.00	0.00
	10%	0.01	-0.00	0.00
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	1.00	-0.09	16.02
	10%	-1.00	0.11	-17.14

INPUT DATA FOR CASE NUMBER 14 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIP1 ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 25.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP1	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
UPDATE DATA FILES ($K)	0.0	22.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 14 — LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	40.	12.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-107.	-67.	-64.
2	20.	40.	12.	20.	75.	22.	10.	60.	17.	87.	30.	6.	30.	9.	1.	41.	18.	-48.
3	10.	0.	0.	0.	75.	45.	25.	150.	44.	219.	75.	15.	75.	10.	1.	447.	233.	131.
4	0.	0.	0.	0.	75.	45.	40.	240.	70.	350.	120.	24.	120.	9.	0.	804.	422.	438.
5	0.	0.	0.	0.	75.	45.	65.	390.	114.	569.	195.	39.	195.	8.	0.	1381.	722.	902.
6	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	7.	0.	1959.	1022.	1513.
7	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	5.	0.	1959.	1021.	2063.
8	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	4.	0.	1959.	1021.	2563.
9	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	3.	0.	1959.	1020.	3016.
10	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	2.	0.	1959.	1020.	3429.
TOTALS	65.	80.	24.	40.	675.	382.		3540.	1032.	5162.	1770.	354.	1770.	64.	5.	12362.	6433.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.47
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 193.3

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.96
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 215.5

SENSITIVITY ANALYSIS FOR CASE NUMBER 14 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 0.47
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 193.3

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.04	0.10	-17.77
	10%	0.04	-0.08	17.46
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.22	0.02	-4.76
	10%	0.22	-0.02	4.44
PERCENT TOOLING SAVINGS	-10%	-0.06	0.01	-1.27
	10%	0.06	-0.01	1.27
PERCENT LABOR SAVINGS	-10%	-0.32	0.04	-6.67
	10%	0.32	-0.03	6.35
PERCENT MATERIAL SAVINGS	-10%	-0.11	0.01	-2.54
	10%	0.11	-0.01	2.22
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.63
	10%	0.02	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.11	0.01	-2.54
	10%	0.11	-0.01	2.22
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.23	-0.06	14.20
	10%	-0.22	0.06	-12.06
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.44	-0.03	4.44
	10%	-0.57	0.03	-4.44
VALUE OF MACHINED PARTS	-10%	-0.73	0.09	-15.23
	10%	0.73	-0.07	15.23
VALUE OF WIPI	-10%	-0.11	0.01	-2.54
	10%	0.11	-0.01	2.22
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.20	0.02	-4.44
	10%	0.20	-0.02	4.13
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.63
	10%	0.03	-0.00	0.63
ORIGINAL PERCENT LABOR COSTS	-10%	-0.18	0.02	-3.81
	10%	0.18	-0.02	3.81
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.03	-0.00	0.95
	10%	-0.03	0.01	-0.95
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.60	-0.06	12.38
	10%	-0.60	0.07	-12.70

INPUT DATA FOR CASE NUMBER 13 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIPI ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 23.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	80.0	100.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
UPDATE DATA FILES ($K)	0.0	60.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	80.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 15 — LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	80.	40.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-155.	-92.	-83.
2	20.	100.	40.	30.	133.	60.	5.	45.	19.	62.	15.	5.	15.	9.	1.	-224.	-120.	-193.
3	10.	80.	0.	20.	135.	90.	20.	180.	75.	250.	60.	20.	60.	10.	1.	310.	162.	-64.
4	0.	0.	0.	0.	135.	90.	35.	315.	131.	437.	105.	35.	105.	9.	0.	904.	474.	276.
5	0.	0.	0.	0.	135.	90.	60.	540.	225.	750.	180.	60.	180.	8.	0.	1710.	893.	857.
6	0.	0.	0.	0.	135.	90.	80.	720.	300.	1000.	240.	80.	240.	7.	0.	2355.	1228.	1584.
7	0.	0.	0.	0.	135.	90.	90.	810.	337.	1125.	270.	90.	270.	5.	0.	2677.	1395.	2333.
8	0.	0.	0.	0.	135.	90.	90.	810.	337.	1125.	270.	90.	270.	4.	0.	2677.	1394.	3017.
9	0.	0.	0.	0.	135.	90.	90.	810.	337.	1125.	270.	90.	270.	3.	0.	2677.	1394.	3637.
10	0.	0.	0.	0.	135.	90.	90.	810.	337.	1125.	270.	90.	270.	2.	0.	2677.	1393.	4200.
TOTALS	65.	260.	80.	50.	1215.	780.		5040.	2100.	7000.	1680.	560.	1680.	64.	5.	15610.	8121.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.86
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 126.5

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.02
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 132.8

SENSITIVITY ANALYSIS FOR CASE NUMBER 13 — LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.86
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 126.5

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	*****	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.58	0.14	-10.93
	10%	0.53	-0.11	10.63
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.16	0.04	-3.02
	10%	0.16	-0.03	3.02
PERCENT TOOLING SAVINGS	-10%	-0.07	0.01	-1.27
	10%	0.07	-0.01	1.11
PERCENT LABOR SAVINGS	-10%	-0.23	0.05	-4.28
	10%	0.23	-0.05	4.13
PERCENT MATERIAL SAVINGS	-10%	-0.05	0.01	-1.11
	10%	0.05	-0.01	0.95
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.48
	10%	0.02	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.05	0.01	-1.11
	10%	0.05	-0.01	0.95
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.16	-0.06	7.30
	10%	-0.15	0.06	-6.51
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.46	-0.06	3.97
	10%	-0.40	0.06	-3.97
VALUE OF MACHINED PARTS	-10%	-0.53	0.13	-10.00
	10%	0.53	-0.10	9.68
VALUE OF WIPI	-10%	-0.05	0.01	-1.11
	10%	0.05	-0.01	0.95
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.15	0.03	-2.86
	10%	0.15	-0.03	2.70
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.04	0.01	-0.79
	10%	0.04	-0.01	0.79
ORIGINAL PERCENT LABOR COSTS	-10%	-0.13	0.03	-2.38
	10%	0.13	-0.03	2.22
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.06	-0.01	1.11
	10%	-0.06	0.01	-1.27
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.43	-0.08	7.78
	10%	-0.43	0.10	-8.09

YEARLY CASH FLOW FOR CASE NUMBER 20

SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS --

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	25.	20.	6.	10.	6.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	-67.	-43.	-41.
2	10.	20.	0.	10.	12.	10.	10.	8.	2.	9.	2.	1.	3.	6.	1.	-36.	-20.	-53.
3	0.	0.	0.	0.	12.	10.	25.	20.	6.	24.	6.	2.	8.	5.	0.	42.	25.	-39.
4	0.	0.	0.	0.	12.	10.	40.	32.	10.	38.	9.	2.	12.	5.	0.	81.	44.	-7.
5	0.	0.	0.	0.	12.	10.	65.	52.	16.	61.	15.	4.	19.	4.	0.	145.	78.	43.
6	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	3.	0.	210.	111.	109.
7	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	3.	0.	210.	110.	168.
8	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	2.	0.	210.	110.	223.
9	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	1.	0.	210.	110.	271.
10	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	1.	0.	210.	109.	315.
TOTALS	33.	40.	6.	20.	114.	90.		472.	143.	553.	133.	33.	177.	35.	2.	1214.	634.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.43
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 61.5

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.77
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 66.9

INPUT DATA FOR CASE NUMBER 20 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIP ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	25.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	6.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 19 — SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.53
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 134.9

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.75	0.14	-10.79
	10%	0.75	-0.11	10.31
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.21	0.04	-3.17
	10%	0.21	-0.03	2.56
PERCENT TOOLING SAVINGS	-10%	-0.03	0.01	-1.11
	10%	0.08	-0.01	0.95
PERCENT LABOR SAVINGS	-10%	-0.29	0.05	-4.13
	10%	0.29	-0.04	3.97
PERCENT MATERIAL SAVINGS	-10%	-0.10	0.02	-1.43
	10%	0.10	-0.02	1.27
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.00
PERCENT WIPI SAVINGS	-10%	-0.06	0.01	-0.95
	10%	0.05	-0.01	0.79
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.18	-0.06	6.98
	10%	-0.17	0.06	-6.35
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.63	-0.06	3.81
	10%	-0.54	0.06	-3.31
VALUE OF MACHINED PARTS	-10%	-0.69	0.13	-9.34
	10%	0.69	-0.10	9.52
VALUE OF WIPI	-10%	-0.06	0.01	-0.95
	10%	0.06	-0.01	0.79
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.19	0.03	-2.86
	10%	0.19	-0.03	2.54
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.48
	10%	0.03	-0.00	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.14	0.02	-2.06
	10%	0.14	-0.02	1.90
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.00	0.00
	10%	-0.01	0.00	-0.16
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.56	-0.08	7.78
	10%	-0.56	0.10	-8.09

YEARLY CASH FLOW FOR CASE NUMBER 19 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

YEAR	PROGRAMMING ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	MISC SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUM. PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	10.	3.	5.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-21.	-11.	-10.
2	0.	0.	0.	0.	6.	4.	10.	5.	2.	7.	2.	0.	2.	0.	0.	8.	4.	-7.
3	0.	0.	0.	0.	6.	4.	23.	12.	4.	17.	6.	1.	4.	0.	0.	34.	18.	7.
4	0.	0.	0.	0.	6.	4.	40.	20.	7.	27.	9.	1.	6.	0.	0.	60.	31.	29.
5	0.	0.	0.	0.	6.	4.	65.	32.	11.	44.	15.	2.	10.	0.	0.	104.	54.	67.
6	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	110.
7	0	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	151.
8	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	189.
9	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	223.
10	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	254.
TOTALS	0.	10.	3.	5.	57.	36.		293.	103.	398.	133.	18.	89.	0.	0.	924.	481.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.53
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 134.9

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.53
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 134.9

INPUT DATA FOR CASE NUMBER :9 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

ANNUAL VALUE OF PARTS ($K) = 3000.0 ANNUAL VALUE OF WIPI ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 23.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIPI	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
UPDATE DATA FILES ($K)	0.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	23.0	40.0	63.0	90.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 18 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.03
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 109.6

	CHANGE	.. NET CHANGES IN ... BCR	VTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.58	0.16	-9.05
	10%	0.53	-0.13	8.73
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.19	0.05	-2.86
	10%	0.19	-0.04	2.86
PERCENT TOOLING SAVINGS	-10%	-0.08	0.02	-1.27
	10%	0.08	-0.02	1.27
PERCENT LABOR SAVINGS	-10%	-0.21	0.05	-3.33
	10%	0.21	-0.05	3.17
PERCENT MATERIAL SAVINGS	-10%	-0.03	0.01	-0.48
	10%	0.03	-0.01	0.48
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.01	-0.32
	10%	0.02	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.05	0.01	-0.79
	10%	0.05	-0.01	0.79
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.22	-0.09	6.82
	10%	-0.21	0.09	-5.87
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.39	-0.05	2.54
	10%	-0.34	0.05	-2.54
VALUE OF MACHINED PARTS	-10%	-0.53	0.14	-8.25
	10%	0.53	-0.12	8.09
VALUE OF WIPI	-10%	-0.05	0.01	-0.79
	10%	0.05	-0.01	0.79
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.17	0.04	-2.70
	10%	0.17	-0.04	2.70
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.05	0.01	-0.79
	10%	0.05	-0.01	0.79
ORIGINAL PERCENT LABOR COSTS	-10%	-0.09	0.02	-1.43
	10%	0.09	-0.02	1.43
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.05	-0.01	0.63
	10%	-0.05	0.01	-0.79
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.44	-0.10	6.82
	10%	-0.44	0.12	-6.82

YEARLY CASH FLOW FOR CASE NUMBER 18

LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	160.	60.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-255.	-144.	-137.
2	20.	200.	60.	30.	135.	60.	5.	60.	26.	67.	10.	7.	15.	9.	1.	-319.	-170.	-284.
3	10.	160.	0.	20.	135.	90.	20.	240.	105.	270.	39.	30.	60.	10.	1.	329.	172.	-149.
4	0.	0.	0.	0.	135.	90.	35.	420.	184.	472.	68.	52.	105.	9.	0.	1077.	564.	256.
5	0.	0.	0.	0.	135.	90.	60.	720.	315.	810.	117.	90.	180.	8.	0.	2057.	1047.	930.
6	0.	0.	0.	0.	135.	90.	80.	960.	420.	1080.	156.	120.	240.	7.	0.	2751.	1434.	1786.
7	0.	0.	0.	0.	135.	90.	90.	1080.	472.	1215.	175.	135.	270.	5.	0.	3123.	1627.	2662.
8	0.	0.	0.	0.	135.	90.	90.	1080.	472.	1215.	175.	135.	270.	4.	0.	3123.	1626.	3457.
9	0.	0.	0.	0.	135.	90.	90.	1080.	472.	1215.	175.	135.	270.	3.	0.	3123.	1625.	4100.
10	0.	0.	0.	0.	135.	90.	90.	1080.	472.	1215.	175.	135.	270.	2.	0.	3123.	1625.	4837.
TOTALS	65.	520.	120.	50.	1215.	780.		6720.	2940.	7560.	1092.	840.	1680.	64.	5.	18982.	9407.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.83
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 109.6

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.97
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 113.0

INPUT DATA FOR CASE NUMBER 18 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIP ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	33.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	160.0	200.0	160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
UPDATE DATA FILES ($K)	0.0	60.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	80.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 17 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.24
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 201.8

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	*****	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.92	0.09	-18.09
	10%	0.92	-0.07	18.09
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.29	0.03	-5.71
	10%	0.29	-0.02	5.71
PERCENT TOOLING SAVINGS	-10%	-0.09	0.01	-1.59
	10%	0.09	-0.01	1.59
PERCENT LABOR SAVINGS	-10%	-0.34	0.03	-6.67
	10%	0.34	-0.03	6.67
PERCENT MATERIAL SAVINGS	-10%	-0.07	0.01	-1.27
	10%	0.07	-0.01	1.27
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.63
	10%	0.03	-0.00	0.63
PERCENT WIPI SAVINGS	-10%	-0.11	0.01	-2.22
	10%	0.11	-0.01	2.22
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.27	-0.06	15.35
	10%	-0.26	0.06	-13.01
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.71	-0.03	4.13
	10%	-0.61	0.03	-4.13
VALUE OF MACHINED PARTS	-10%	-0.81	0.08	-16.19
	10%	0.81	-0.07	16.19
VALUE OF WIPI	-10%	-0.11	0.01	-2.22
	10%	0.11	-0.01	2.22
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.26	0.02	-5.40
	10%	0.26	-0.02	5.40
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.63
	10%	0.03	-0.00	0.63
ORIGINAL PERCENT LABOR COSTS	-10%	-0.16	0.01	-3.17
	10%	0.16	-0.01	3.17
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.04	-0.00	0.95
	10%	-0.04	0.00	-0.95
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.68	-0.06	13.33
	10%	-0.68	0.07	-13.33

YEARLY CASH FLOW FOR CASE NUMBER 17 LARGE, HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	50.	12.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-117.	-72.	-69.
2	20.	50.	12.	20.	75.	22.	10.	80.	24.	94.	19.	9.	30.	9.	1.	58.	26.	-45.
3	10.	0.	0.	0.	75.	45.	25.	200.	61.	236.	49.	22.	75.	10.	1.	514.	268.	163.
4	0.	0.	0.	0.	75.	45.	40.	320.	98.	378.	78.	36.	120.	9.	0.	910.	478.	507.
5	0.	0.	0.	0.	75.	45.	65.	520.	159.	614.	127.	58.	195.	8.	0.	1554.	812.	1036.
6	0.	0.	0.	0.	75.	45.	90.	720.	220.	850.	175.	81.	270.	7.	0.	2197.	1146.	1714.
7	0.	0.	0.	0.	75.	45.	90.	720.	220.	850.	175.	81.	270.	5.	0.	2197.	1145.	2331.
8	0.	0.	0.	0.	75.	45.	90.	720.	220.	850.	175.	81.	270.	4.	0.	2197.	1145.	2891.
9	0.	0.	0.	0.	75.	45.	90.	720.	220.	850.	175.	81.	270.	3.	0.	2197.	1144.	3400.
10	0.	0.	0.	0.	75.	45.	90.	720.	220.	850.	175.	81.	270.	2.	0.	2197.	1144.	3862.
TOTALS	65.	100.	24.	40.	675.	382.		4720.	1445.	5575.	1150.	531.	1770.	64.	5.	13906.	7235.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.24
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 201.8

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.77
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 223.7

INPUT DATA FOR CASE NUMBER 17 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIPI ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.9%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
UPDATE DATA FILES ($K)	0.0	22.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 16 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1
****

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.91
YEARS TO PAYBACK = 1.9
RETURN ON INVESTMENT = 241.2

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-1.32	0.11	-20.00
	10%	1.39	-0.12	20.90
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.40	0.04	-5.71
	10%	0.40	-0.04	5.71
PERCENT TOOLING SAVINGS	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	2.22
PERCENT LABOR SAVINGS	-10%	-0.54	0.06	-7.62
	10%	0.54	-0.05	7.93
PERCENT MATERIAL SAVINGS	-10%	-0.16	0.02	-2.22
	10%	0.16	-0.02	2.22
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.04	0.00	-0.32
	10%	0.04	-0.00	0.63
PERCENT WIPI SAVINGS	-10%	-0.12	0.01	-1.59
	10%	0.12	-0.01	1.90
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.27	-0.08	14.28
	10%	-0.26	0.08	-12.06
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	1.23	-0.06	7.36
	10%	-1.04	0.07	-6.67
VALUE OF MACHINED PARTS	-10%	-1.27	0.10	-10.41
	10%	1.27	-0.11	10.09
VALUE OF WIPI	-10%	-0.12	0.01	-1.59
	10%	0.12	-0.01	1.90
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.36	0.04	-5.08
	10%	0.36	-0.04	5.40
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.01	-0.63
	10%	0.03	-0.01	0.95
ORIGINAL PERCENT LABOR COSTS	-10%	-0.27	0.03	-3.81
	10%	0.27	-0.03	3.81
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.00	0.32
	10%	-0.01	0.00	0.00
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	1.06	-0.10	15.23
	10%	-1.06	0.09	-15.23

YEARLY CASH FLOW FOR CASE NUMBER 16 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	60.	6.	10.	18.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-94.	-49.	-47.
2	0.	0.	6.	0.	36.	20.	10.	30.	17.	67.	19.	5.	13.	0.	0.	112.	58.	4.
3	0.	0.	0.	0.	36.	20.	25.	125.	44.	169.	49.	11.	37.	0.	0.	379.	197.	159.
4	0.	0.	0.	0.	36.	20.	40.	200.	70.	270.	78.	18.	60.	0.	0.	640.	333.	398.
5	0.	0.	0.	0.	36.	20.	65.	325.	114.	439.	127.	29.	98.	0.	0.	1075.	559.	762.
6	0.	0.	0.	0.	36.	20.	90.	450.	157.	607.	175.	40.	135.	0.	0.	1510.	785.	1225.
7	0.	0.	0.	0.	36.	20.	90.	450.	157.	607.	175.	40.	135.	0.	0.	1510.	785.	1649.
8	0.	0.	0.	0.	36.	20.	90.	450.	157.	607.	175.	40.	135.	0.	0.	1510.	785.	2033.
9	0.	0.	0.	0.	36.	20.	90.	450.	157.	607.	175.	40.	135.	0.	0.	1510.	785.	2383.
10	0.	0.	0.	0.	36.	20.	90.	450.	157.	607.	175.	40.	135.	0.	0.	1510.	785.	2700.
TOTALS	0.	60.	12.	10.	342.	180.		2950.	1032.	3982.	1150.	265.	885.	0.	0.	9662.	5024.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.91
YEARS TO PAYBACK = 1.9
RETURN ON INVESTMENT = 241.2

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 13.91
YEARS TO PAYBACK = 1.9
RETURN ON INVESTMENT = 241.2

INPUT DATA FOR CASE NUMBER 16 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1
****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIP ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIP	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
UPDATE DATA FILES ($K)	0.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

INPUT DATA FOR CASE NUMBER 21 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

****

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIP ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	25.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	60.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
UPDATE DATA FILES ($K)	0.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	80.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 20 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.43
YEARS TO PAYBACK = 4.1
RETURN ON INVESTMENT = 61.5

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.33	0.19	-5.24
	10%	0.33	-0.15	5.00
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.10	0.05	-1.59
	10%	0.10	-0.05	1.59
PERCENT TOOLING SAVINGS	-10%	-0.03	0.02	-0.48
	10%	0.03	-0.02	0.48
PERCENT LABOR SAVINGS	-10%	-0.12	0.06	-1.90
	10%	0.12	-0.06	1.82
PERCENT MATERIAL SAVINGS	-10%	-0.03	0.01	-0.40
	10%	0.03	-0.01	0.40
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.08
	10%	0.01	-0.00	0.08
PERCENT WIPI SAVINGS	-10%	-0.04	0.02	-0.56
	10%	0.04	-0.02	0.56
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.17	-0.11	3.89
	10%	-0.15	0.11	-3.41
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.18	-0.06	1.51
	10%	-0.17	0.06	-1.51
VALUE OF MACHINED PARTS	-10%	-0.29	0.16	-4.60
	10%	0.29	-0.13	4.36
VALUE OF WIPI	-10%	-0.04	0.02	-0.56
	10%	0.04	-0.02	0.36
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.10	0.05	-1.51
	10%	0.10	-0.03	1.51
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.01	-0.24
	10%	0.01	-0.01	0.16
ORIGINAL PERCENT LABOR COSTS	-10%	-0.06	0.03	-0.87
	10%	0.06	-0.03	0.87
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.01	0.24
	10%	-0.02	0.01	-0.24
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.08
	10%	0.00	-0.00	0.08
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.24	-0.11	3.65
	10%	-0.24	0.13	-3.73

YEARLY CASH FLOW FOR CASE NUMBER 21 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

		DATA FILES ($K)															
					& PROGRAM		OF PARTS IMPACTED (%)										
						DATA FILES ($K)		LABOR SAVINGS ($K)									
	1	25.	40.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.	2.	-65.	-53.	-53.
	2	10.	60.	0.	20.	30.	20.	3.	6.	1.	2.	1.	1.	3.	1.	-121.	-64.	-104.
	3	0.	40.	0.	10.	30.	40.	20.	24.	10.	27.	4.	3.	5.	0.	-46.	-21.	-121.
	4	0.	0.	0.	0.	30.	40.	35.	42.	18.	47.	7.	3.	10.	0.	59.	33.	-99.
	5	0.	0.	0.	0.	30.	40.	60.	72.	31.	81.	13.	6.	18.	0.	152.	81.	-46.
	6	0.	0.	0.	0.	30.	40.	80.	96.	42.	108.	18.	8.	24.	0.	226.	119.	24.
	7	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	0.	263.	138.	99.
	8	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	0.	263.	138.	166.
	9	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	0.	263.	137.	227.
	10	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	0.	263.	137.	281.
	TOTALS	35.	140.	20.	30.	270.	340.		672.	294.	756.	126.	56.	168.	3.	1237.	646.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.91
YEARS TO PAYBACK = 5.7
RETURN ON INVESTMENT = 30.2

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.97
YEARS TO PAYBACK = 5.7
RETURN ON INVESTMENT = 39.8

SENSITIVITY ANALYSIS FOR CASE NUMBER 21 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.91
YEARS TO PAYBACK = 5.7
RETURN ON INVESTMENT = 38.2

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.19	0.36	-4.60
	10%	0.19	-0.28	4.44
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.06	0.11	-1.43
	10%	0.06	-0.10	1.51
PERCENT TOOLING SAVINGS	-10%	-0.03	0.05	-0.63
	10%	0.03	-0.04	0.63
PERCENT LABOR SAVINGS	-10%	-0.07	0.12	-1.67
	10%	0.07	-0.11	1.67
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.24
	10%	0.01	-0.02	0.32
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.08
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.02	0.03	-0.32
	10%	0.02	-0.03	0.40
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.07	-0.15	2.70
	10%	-0.07	0.15	-2.30
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, *UPDATING FILES*)	-10%	0.13	-0.16	2.14
	10%	-0.11	0.17	-2.06
VALUE OF MACHINED PARTS	-10%	-0.17	0.33	-4.20
	10%	0.17	-0.26	4.43
VALUE OF WIPI	-10%	-0.02	0.03	-0.32
	10%	0.02	-0.03	0.40
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.06	0.10	-1.35
	10%	0.06	-0.09	1.43
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.03	-0.32
	10%	0.02	-0.03	0.40
ORIGINAL PERCENT LABOR COSTS	-10%	-0.03	0.05	-0.71
	10%	0.03	-0.05	0.79
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.03	0.48
	10%	-0.02	0.03	-0.40
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.08
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.14	-0.22	3.41
	10%	-0.14	0.26	-3.49

INPUT DATA FOR CASE NUMBER 22 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIP1 ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 3.0%
DIRECT LABOR	= 25.0%	MATERIAL	= 14.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIP1	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
UPDATE DATA FILES ($K)	0.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 22 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIPI SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	13.	3.	5.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-26.	-14.	-13.
2	0.	0.	0.	0.	6.	4.	10.	6.	2.	6.	2.	0.	2.	0.	0.	9.	4.	-9.
3	0.	0.	0.	0.	6.	4.	23.	16.	5.	16.	5.	1.	4.	0.	0.	36.	19.	6.
4	0.	0.	0.	0.	6.	4.	40.	23.	8.	23.	8.	2.	6.	0.	0.	64.	33.	30.
5	0.	0.	0.	0.	6	4.	63.	41.	13.	41.	14.	3.	10.	0.	0.	111.	57.	67.
6	0.	0.	0.	0.	6.	4.	90.	56.	18.	56.	19.	4.	14.	0.	0.	157.	82.	116.
7	0.	0.	0.	0.	6.	4.	90.	56.	18.	56.	19.	4.	14.	0.	0.	157.	82.	159.
8	0.	0.	0.	0.	6.	4.	90.	56.	18.	56.	19.	4.	14.	0.	0.	157.	82.	199.
9	0.	0.	0.	0.	6.	4.	90.	56.	18.	56.	19.	4.	14.	0.	0.	157.	82.	236.
10	0.	0.	0.	0.	6.	4.	90.	56.	18.	56.	19.	4.	14.	0.	0.	157.	82.	269.
TOTALS	0.	13.	3.	5.	57.	36.		369.	118.	369.	124.	27.	89.	0.	0.	978.	509.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.48
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 124.4

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.48
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 124.4

SENSITIVITY ANALYSIS FOR CASE NUMBER 22 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 7.48
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 124.4

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.73	0.15	-9.68
	10%	0.75	-0.12	9.20
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.25	0.05	-3.33
	10%	0.25	-0.04	3.17
PERCENT TOOLING SAVINGS	-10%	-0.08	0.01	-1.11
	10%	0.08	-0.01	0.95
PERCENT LABOR SAVINGS	-10%	-0.25	0.05	-3.33
	10%	0.25	-0.04	3.17
PERCENT MATERIAL SAVINGS	-10%	-0.08	0.02	-1.11
	10%	0.03	-0.01	0.95
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.32
	10%	0.02	-0.00	0.16
PERCENT WIPI SAVINGS	-10%	-0.06	0.01	-0.79
	10%	0.06	-0.01	0.63
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.21	-0.08	6.02
	10%	-0.20	0.08	-6.03
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.56	-0.06	3.02
	10%	-0.51	0.06	-3.17
VALUE OF MACHINED PARTS	-10%	-0.69	0.14	-8.89
	10%	0.69	-0.11	8.57
VALUE OF WIPI	-10%	-0.06	0.01	-0.79
	10%	0.06	-0.01	0.63
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.23	0.04	-3.02
	10%	0.23	-0.04	2.86
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.48
	10%	0.03	-0.00	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.11	0.02	-1.43
	10%	0.11	-0.02	1.27
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.00	0.00
	10%	-0.01	0.00	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	-0.16
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.56	-0.09	6.98
	10%	-0.56	0.11	-7.30

INPUT DATA FOR CASE NUMBER 23 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

****

ANNUAL VALUE OF PARTS ($K) = 3000.0 ANNUAL VALUE OF WIP ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 8.0%
DIRECT LABOR	= 25.0%	MATERIAL	= 11.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	25.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	6.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	10.0	25.0	40.0	65.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 23 — SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	25.	30.	6.	10.	6.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	-77.	-48.	-46.
2	10.	30.	0.	10.	13.	10.	10.	10.	3.	9.	2.	1.	3.	6.	1.	-44.	-24.	-67.
3	0.	0.	0.	0.	13.	10.	25.	25.	7.	22.	5.	2.	8.	5.	0.	47.	27.	-46.
4	0.	0.	0.	0.	12.	10.	40.	40.	11.	35.	8.	4.	12.	5.	0.	88.	48.	-11.
5	0.	0.	0.	0.	12.	10.	65.	63.	18.	57.	14.	6.	19.	4.	0.	157.	84.	43.
6	0.	0.	0.	0.	12.	10.	90.	90.	25.	79.	19.	8.	27.	3.	0.	226.	119.	114.
7	0.	0.	0.	0.	13.	10.	90.	90.	25.	79.	19.	8.	27.	3.	0.	226.	119.	170.
8	0.	0.	0.	0.	12.	10.	90.	90.	25.	79.	19.	8.	27.	2.	0.	226.	118.	225.
9	0.	0.	0.	0.	12.	10.	90.	90.	25.	79.	19.	8.	27.	1.	0.	226.	118.	283.
10	0.	0.	0.	0.	12.	10.	90.	90.	25.	79.	19.	8.	27.	1.	0.	226.	118.	336.
TOTALS	35.	60.	6.	20.	114.	90.		590.	165.	516.	124.	53.	177.	36.	2.	1300.	679.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.41
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 59.4

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.73
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 63.9

SENSITIVITY ANALYSIS FOR CASE NUMBER 23 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.41
YEARS TO PAYBACK = 4.2
RETURN ON INVESTMENT = 59.4

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.33	0.19	-5.08
	10%	0.33	-0.16	4.84
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.12	0.07	-1.82
	10%	0.12	-0.06	1.75
PERCENT TOOLING SAVINGS	-10%	-0.03	0.02	-0.56
	10%	0.03	-0.02	0.48
PERCENT LABOR SAVINGS	-10%	-0.11	0.06	-1.59
	10%	0.11	-0.05	1.51
PERCENT MATERIAL SAVINGS	-10%	-0.03	0.01	-0.40
	10%	0.01	-0.01	0.40
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.24
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.04	0.02	-0.56
	10%	0.04	-0.02	0.56
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.18	-0.12	3.09
	10%	-0.16	0.11	-3.41
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.17	-0.06	1.35
	10%	-0.13	0.06	-1.35
VALUE OF MACHINED PARTS	-10%	-0.30	0.17	-4.52
	10%	0.30	-0.14	4.28
VALUE OF WIPI	-10%	-0.04	0.02	-0.56
	10%	0.04	-0.02	0.56
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.11	0.06	-1.67
	10%	0.11	-0.06	1.67
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.01	-0.24
	10%	0.01	-0.01	0.16
ORIGINAL PERCENT LABOR COSTS	-10%	-0.03	0.02	-0.63
	10%	0.03	-0.02	0.56
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.01	0.24
	10%	-0.02	0.01	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.08
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.24	-0.12	3.57
	10%	-0.24	0.14	-3.73

INPUT DATA FOR CASE NUMBER 24 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

****

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIP ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 3.0%
DIRECT LABOR	= 23.0%	MATERIAL	= 14.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 47.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIP	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	25.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	80.0	120.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
UPDATE DATA FILES ($K)	0.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	5.0	20.0	35.0	60.0	80.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 24

SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	25.	60.	30.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	-135.	-70.	-73.
2	10.	120.	0.	20.	30.	20.	5.	7.	3.	6.	1.	1.	2.	6.	1.	-180.	-95.	-157.
3	0.	80.	0.	10.	30.	40.	20.	30.	12.	25.	4.	3.	6.	5.	0.	-80.	-39.	-183.
4	0.	0.	0.	0.	30.	40.	35.	52.	21.	44.	7.	5.	10.	5.	0.	70.	39.	-160.
5	0.	0.	0.	0.	30.	40.	60.	90.	36.	75.	13.	9.	18.	4.	0.	171.	91.	-101.
6	0.	0.	0.	0.	30.	40.	80.	120.	48.	100.	17.	12.	24.	3.	0.	251.	132.	-23.
7	0.	0.	0.	0.	30.	40.	90.	135.	54.	112.	19.	13.	27.	3.	0.	291.	153.	60.
8	0.	0.	0.	0.	30.	40.	90.	135.	54.	112.	19.	13.	27.	2.	0.	291.	152.	134.
9	0.	0.	0.	0.	30.	40.	90.	135.	54.	112.	19.	13.	27.	1.	0.	291.	152.	202.
10	0.	0.	0.	0.	30.	40.	90.	135.	54.	112.	19.	13.	27.	1.	0.	291.	152.	263.
TOTALS	35.	260.	30.	30.	270.	340.		840.	336.	700.	118.	84.	168.	35.	2.	1261.	658.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.70
YEARS TO PAYBACK = 6.3
RETURN ON INVESTMENT = 29.9

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.73
YEARS TO PAYBACK = 6.3
RETURN ON INVESTMENT = 30.7

SENSITIVITY ANALYSIS FOR CASE NUMBER 24 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.70
YEARS TO PAYBACK = 6.3
RETURN ON INVESTMENT = 29.9

	CHANGE	.. NET CHANGES IN ... DCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.17	0.42	-4.03
	10%	0.17	-0.33	3.81
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.06	0.14	-1.43
	10%	0.06	-0.13	1.51
PERCENT TOOLING SAVINGS	-10%	-0.02	0.06	-0.56
	10%	0.02	-0.05	0.63
PERCENT LABOR SAVINGS	-10%	-0.03	0.12	-1.19
	10%	0.03	-0.11	1.27
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.16
	10%	0.01	-0.02	0.24
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.08
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.01	0.03	-0.24
	10%	0.01	-0.03	0.32
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.08	-0.21	2.62
	10%	-0.03	0.21	-2.22
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.09	-0.15	1.59
	10%	-0.03	0.16	-1.51
VALUE OF MACHINED PARTS	-10%	-0.15	0.38	-3.73
	10%	0.15	-0.31	3.57
VALUE OF WIPI	-10%	-0.01	0.03	-0.24
	10%	0.01	-0.03	0.32
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.06	0.13	-1.35
	10%	0.06	-0.12	1.35
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.03	-0.32
	10%	0.01	-0.03	0.40
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.04	-0.40
	10%	0.02	-0.04	0.48
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.03	0.40
	10%	-0.01	0.03	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.13	-0.25	2.94
	10%	-0.13	0.31	-3.02

INPUT DATA FOR CASE NUMBER 25 COMPOSITE (CASE 1 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

****

ANNUAL VALUE OF PARTS ($K) = 18900.0 ANNUAL VALUE OF WIPI ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 23.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

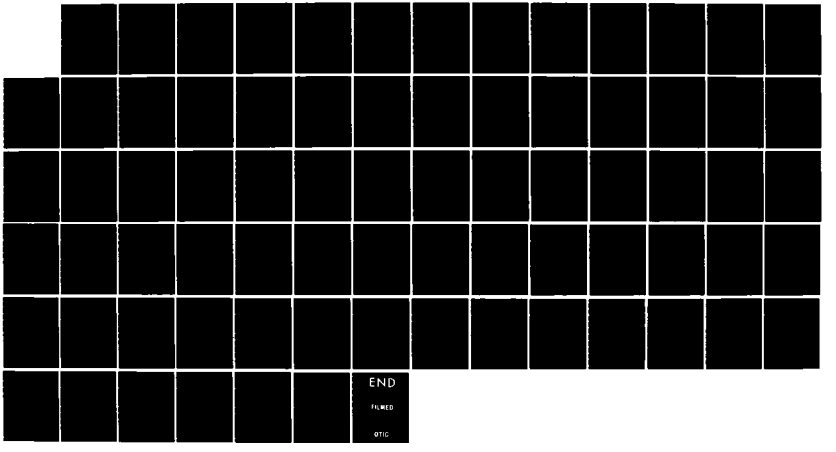
PROCESS PLANNING	= 23.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 4.0%	WIPI	= 2.0%

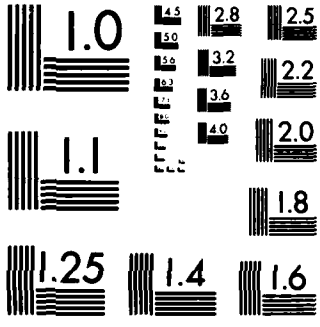
YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	39.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	13.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
UPDATE DATA FILES ($K)	0.0	6.5	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	31.0	63.0	73.0	83.0	83.0	83.0	83.0	83.0

AD-A151 719 COMPUTERIZED PRODUCTION PROCESS PLANNING VOLUME 4 APPENDICES D E AND F TO BENEFIT ANALYSIS(U) IIT RESEARCH INST CHICAGO IL H H SHU ET AL. NOV 76 2/2

UNCLASSIFIED DAAH01-76-C-1104 F/G 5/3 NL





YEARLY CASH FLOW FOR CASE NUMBER 25 COMPOSITE (CASE 1 BUT W/UITC FPI) -- CYL PARTS -- SYS 1

YR	[illegible] ($K)	ES APPLICN DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	VERIFYING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PRODUCTION PLANNING SAVINGS ($K)	[illegible] ($K)	[illegible] SAVINGS ($K)	[illegible] ($K)	[illegible] SAVINGS ($K)	[illegible] ($K)	[illegible] ($K)	[illegible] ($K)	CASH FLOW BEFORE TAXES & [illegible] ($K)	CASH FLOW AFTER TAXES & [illegible] ($K)	PRESENT VALUE AFTER [illegible] ($K)
1	40.	39.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.	3.	-79.	-54.	-51.
2	0.	0.	7.	10.	13.	7.	12.	51.	8.	32.	16.	4.	16.	7.	0.	89.	60.	-8.
3	0.	0.	0.	0.	26.	13.	31.	131.	21.	82.	40.	9.	42.	6.	0.	286.	192.	111.
4	0.	0.	0.	0.	26.	13.	63.	267.	42.	167.	82.	19.	83.	5.	0.	622.	326.	345.
5	0.	0.	0.	0.	26.	13.	75.	318.	50.	198.	98.	23.	101.	4.	0.	748.	391.	599.
6	0.	0.	0.	0.	26.	13.	83.	360.	56.	225.	111.	26.	115.	4.	0.	873.	445.	863.
7	0.	0.	0.	0.	26.	13.	83.	360.	56.	225.	111.	26.	113.	3.	0.	833.	445.	1103.
8	0.	0.	0.	0.	26.	13.	83.	360.	56.	225.	111.	26.	113.	2.	0.	853.	445.	1329.
9	0.	0.	0.	0.	26.	13.	83.	360.	56.	225.	111.	26.	113.	1.	0.	873.	444.	1518.
10	0.	0.	0.	0.	26.	13.	83.	360.	56.	225.	111.	26.	113.	1.	0.	853.	444.	1693.
TOTALS	40.	39.	7.	10.	221.	110.		2566.	401.	1603.	790.	183.	818.	40.	3.	6934.	3009.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 11.12
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 197.7

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 12.37
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 232.3

SENSITIVITY ANALYSIS FOR CASE NUMBER 23 COMPOSITE (CASE 1 BUT W/UTHC PPI) -- CYL PARTS -- SYS 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 11.12
YEARS TO PAYBACK = 2.1
RETURN ON INVESTMENT = 197.7

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-1.10	0.06	-15.23
	10%	1.10	-0.05	14.92
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.44	0.02	-6.03
	10%	0.44	-0.02	6.03
PERCENT TOOLING SAVINGS	-10%	-0.07	0.00	-0.95
	10%	0.07	-0.00	0.95
PERCENT LABOR SAVINGS	-10%	-0.28	0.01	-3.81
	10%	0.28	-0.01	3.81
PERCENT MATERIAL SAVINGS	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	1.90
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.32
	10%	0.03	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	1.90
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.41	-0.03	14.60
	10%	-0.41	0.03	-12.38
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.72	-0.01	1.59
	10%	-0.64	0.01	-1.59
VALUE OF MACHINED PARTS	-10%	-0.96	0.03	-13.33
	10%	0.96	-0.04	13.01
VALUE OF WIPI	-10%	-0.14	0.01	-1.90
	10%	0.14	-0.01	1.90
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.40	0.02	-5.40
	10%	0.40	-0.02	5.40
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	0.00
	10%	0.01	-0.00	0.32
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.11	-0.01	1.59
	10%	-0.11	0.01	-1.59
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.01	-0.00	0.00
	10%	-0.01	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.41	-0.02	5.71
	10%	-0.41	0.02	-5.71

INPUT DATA FOR CASE NUMBER 26 COMPOSITE (CASE 2 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

****

ANNUAL VALUE OF PARTS ($K) = 18900.0 ANNUAL VALUE OF WIPI ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 28.0%	MATERIAL	= 23.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 39.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	117.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	119.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	15.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
UPDATE DATA FILES ($K)	0.0	13.5	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	31.0	63.0	75.0	85.0	85.0	85.0	85.0	85.0

YEARLY CASH FLOW FOR CASE NUMBER 26 COMPOSITE (CASE 2 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER DEPRECIATION ($K)
1	117.	119.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	21.	0.	-236.	-160.	-151.
2	0.	0.	11.	18.	15.	13.	12.	71.	11.	44.	16.	5.	32.	19.	0.	122.	73.	-93.
3	0.	0.	0.	0.	30.	27.	31.	183.	29.	115.	40.	14.	84.	17.	0.	498.	220.	81.
4	0.	0.	0.	0.	30.	27.	63.	371.	58.	233.	82.	29.	170.	15.	0.	887.	468.	419.
5	0.	0.	0.	0.	30.	27.	75.	442.	69.	278.	98.	34.	203.	13.	0.	1067.	561.	707.
6	0.	0.	0.	0.	30.	27.	83.	501.	79.	315.	111.	39.	230.	11.	0.	1217.	638.	1162.
7	0.	0.	0.	0.	30.	27.	83.	501.	79.	315.	111.	39.	231.	9.	0.	1217.	637.	1505.
8	0.	0.	0.	0.	30.	27.	83.	501.	79.	315.	111.	39.	230.	6.	0.	1217.	636.	1815.
9	0.	0.	0.	0.	30.	27.	85.	501.	79.	315.	111.	39.	230.	4.	0.	1217.	635.	2098.
10	0.	0.	0.	0.	30.	27.	85.	501.	79.	315.	111.	39.	230.	2.	0.	1217.	634.	2354.
TOTALS	117.	119.	11.	18.	255.	229.		3373.	561.	2245.	790.	275.	1636.	117.	0.	8331.	4341.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.06
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 123.9

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.42
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 143.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 26 COMPOSITE (CASE 2 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.06
YEARS TO PAYBACK = 2.5
RETURN ON INVESTMENT = 123.9

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.79	0.12	-9.03
	10%	0.79	-0.09	8.73
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.31	0.04	-3.49
	10%	0.31	-0.04	3.49
PERCENT TOOLING SAVINGS	-10%	-0.03	0.01	-0.43
	10%	0.05	-0.01	0.38
PERCENT LABOR SAVINGS	-10%	-0.20	0.03	-2.22
	10%	0.20	-0.02	2.22
PERCENT MATERIAL SAVINGS	-10%	-0.07	0.01	-0.79
	10%	0.07	-0.01	0.79
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.16
	10%	0.02	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.14	0.02	-1.59
	10%	0.14	-0.02	1.59
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.45	-0.09	8.73
	10%	-0.41	0.09	-7.30
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.38	-0.01	0.79
	10%	-0.35	0.01	-0.79
VALUE OF MACHINED PARTS	-10%	-0.65	0.09	-7.30
	10%	0.65	-0.08	7.14
VALUE OF WIPI	-10%	-0.14	0.02	-1.59
	10%	0.14	-0.02	1.59
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.28	0.04	-3.17
	10%	0.28	-0.04	3.17
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.16
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.00	-0.16
	10%	0.03	-0.00	0.16
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.10	-0.01	1.11
	10%	-0.10	0.01	-1.11
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.28	-0.04	3.17
	10%	-0.28	0.04	-3.02

INPUT DATA FOR CASE NUMBER 27 — COMPOSITE (CASE 3 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

****

ANNUAL VALUE OF PARTS ($K) = 18900.0 — ANNUAL VALUE OF WIPI ($K) = 22500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 8.0%	TOOLING	= 7.0%
DIRECT LABOR	= 28.0%	MATERIAL	= 23.0%
SCRAP & REWORK	= 4.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 50.0%	TOOLING	= 12.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 4.0%
SCRAP & REWORK	= 10.0%	WIPI	= 6.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	224.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	157.0	157.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	29.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0	57.0
UPDATE DATA FILES ($K)	0.0	23.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	8.0	24.0	55.0	66.0	74.0	80.0	83.0	85.0	87.0

YEARLY CASH FLOW FOR CASE NUMBER 27 COMPOSITE (CASE 3 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIPI SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	224.	157.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	41.	16.	-381.	-270.	-253.
2	0.	157.	19.	34.	29.	23.	8.	70.	13.	42.	14.	6.	32.	37.	0.	-84.	-26.	-201.
3	0.	0.	0.	0.	57.	46.	24.	210.	38.	127.	42.	18.	97.	33.	0.	430.	239.	-92.
4	0.	0.	0.	0.	57.	46.	53.	482.	87.	291.	96.	42.	223.	29.	0.	1110.	595.	334.
5	0.	0.	0.	0.	57.	46.	66.	579.	103.	349.	115.	50.	267.	24.	0.	1362.	720.	803.
6	0.	0.	0.	0.	57.	46.	74.	649.	117.	393.	129.	56.	300.	20.	0.	1539.	810.	1202.
7	0.	0.	0.	0.	57.	46.	80.	702.	127.	423.	139.	60.	324.	16.	0.	1673.	878.	1755.
8	0.	0.	0.	0.	57.	46.	83.	743.	135.	450.	148.	64.	344.	12.	0.	1783.	933.	2211.
9	0.	0.	0.	0.	57.	46.	85.	745.	133.	450.	148.	64.	344.	8.	0.	1783.	931.	2626.
10	0.	0.	0.	0.	57.	46.	85.	743.	135.	450.	148.	64.	344.	4.	0.	1783.	929.	3001.
TOTALS	224.	314.	19.	34.	485.	391.		4929.	892.	2974.	977.	425.	2276.	224.	16.	11006.	5739.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.57
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 88.9

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.43
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 101.1

SENSITIVITY ANALYSIS FOR CASE NUMBER 27 COMPOSITE (CASE 3 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.57
YEARS TO PAYBACK = 3.2
RETURN ON INVESTMENT = 88.9

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.54	0.10	-6.59
	10%	0.54	-0.08	6.27
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.21	0.04	-2.62
	10%	0.21	-0.04	2.46
PERCENT TOOLING SAVINGS	-10%	-0.04	0.01	-0.40
	10%	0.04	-0.01	0.40
PERCENT LABOR SAVINGS	-10%	-0.13	0.02	-1.51
	10%	0.13	-0.02	1.51
PERCENT MATERIAL SAVINGS	-10%	-0.04	0.01	-0.76
	10%	0.04	-0.01	0.56
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.24
	10%	0.02	-0.00	0.24
PERCENT WIPI SAVINGS	-10%	-0.10	0.02	-1.19
	10%	0.10	-0.02	1.19
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.33	-0.08	6.11
	10%	-0.30	0.08	-5.16
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.24	-0.02	0.87
	10%	-0.22	0.02	-0.87
VALUE OF MACHINED PARTS	-10%	-0.44	0.08	-5.32
	10%	0.44	-0.07	5.16
VALUE OF WIPI	-10%	-0.10	0.02	-1.19
	10%	0.10	-0.02	1.19
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.19	0.03	-2.30
	10%	0.19	-0.03	2.30
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.00	-0.08
	10%	0.01	-0.00	0.08
ORIGINAL PERCENT LABOR COSTS	-10%	-0.01	0.00	-0.08
	10%	0.01	-0.00	0.08
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.03	-0.01	0.37
	10%	-0.03	0.01	-0.37
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.08
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.19	-0.03	2.30
	10%	-0.19	0.03	-2.30

INPUT DATA FOR CASE NUMBER 28 MED/SIM PARTS (CASE 7 BUT W/UTHC PPI) -- CYL PARTS -- SYS 1

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 50.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 23.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIPI	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	9.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	31.0	50.0	70.0	80.0	80.0	80.0	80.0	80.0

YEARLY CASH FLOW FOR CASE NUMBER 28 MED/SIM PARTS (CASE 7 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	30.	3.	10.	9.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-52.	-27.	-25.
2	0.	0.	3.	0.	18.	10.	12.	15.	4.	12.	5.	1.	4.	0.	0.	11.	6.	-21.
3	0.	0.	0.	0.	18.	10.	31.	39.	11.	31.	14.	3.	11.	0.	0.	81.	42.	12.
4	0.	0.	0.	0.	18.	10.	58.	72.	20.	58.	26.	5.	21.	0.	0.	175.	91.	77.
5	0.	0.	0.	0.	18.	10.	70.	87.	24.	70.	31.	6.	25.	0.	0.	217.	113.	151.
6	0.	0.	0.	0.	18.	10.	80.	100.	28.	80.	36.	7.	29.	0.	0.	252.	131.	223.
7	0.	0.	0.	0.	18.	10.	80.	100.	28.	80.	36.	7.	29.	0.	0.	252.	131.	290.
8	0.	0.	0.	0.	18.	10.	80.	100.	28.	80.	36.	7.	29.	0.	0.	252.	131.	363.
9	0.	0.	0.	0.	18.	10.	80.	100.	28.	80.	36.	7.	29.	0.	0.	252.	131.	421.
10	0.	0.	0.	0.	18.	10.	80.	100.	28.	80.	36.	7.	29.	0.	0.	252.	131.	474.
TOTALS	0.	30.	6.	10.	171.	90.		714.	200.	571.	257.	51.	206.	0.	0.	1692.	880.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.43
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 123.5

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 5.43
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 123.5

SENSITIVITY ANALYSIS FOR CASE NUMBER 20 MED/SIM PARTS (CASE 7 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.43
YEARS TO PAYBACK = 2.6
RETURN ON INVESTMENT = 123.5

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.54	0.16	-10.95
	10%	0.54	-0.13	10.63
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.19	0.05	-3.81
	10%	0.19	-0.05	3.81
PERCENT TOOLING SAVINGS	-10%	-0.05	0.01	-1.11
	10%	0.05	-0.01	1.11
PERCENT LABOR SAVINGS	-10%	-0.16	0.04	-3.02
	10%	0.16	-0.04	3.02
PERCENT MATERIAL SAVINGS	-10%	-0.07	0.02	-1.43
	10%	0.07	-0.02	1.43
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.06	0.01	-1.11
	10%	0.05	-0.01	1.11
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.12	-0.07	6.67
	10%	-0.11	0.07	-5.87
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.46	-0.07	4.60
	10%	-0.40	0.08	-4.28
VALUE OF MACHINED PARTS	-10%	-0.49	0.13	-9.68
	10%	0.49	-0.11	9.36
VALUE OF WIPI	-10%	-0.06	0.01	-1.11
	10%	0.06	-0.01	1.11
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.18	0.03	-3.49
	10%	0.18	-0.04	3.49
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.01	-0.38
	10%	0.02	-0.01	0.43
ORIGINAL PERCENT LABOR COSTS	-10%	-0.07	0.02	-1.43
	10%	0.07	-0.02	1.43
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.00	-0.00	0.16
	10%	-0.00	0.00	-0.16
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.00
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.49	-0.11	9.36
	10%	-0.49	0.13	-9.68

INPUT DATA FOR CASE NUMBER 29 MED/SIM PARTS (CASE 8 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHANGES & MAINTENANCE ($K)	0.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
UPDATE DATA FILES ($K)	0.0	18.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	12.0	31.0	38.0	70.0	80.0	80.0	80.0	80.0	80.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 33 LC/HIGH SIM PARTS (CASE 13 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.70
YEARS TO PAYBACK = 2.7
RETURN ON INVESTMENT = 171.7

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.67	0.16	-14.92
	10%	0.67	-0.12	14.60
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.19	0.04	-4.13
	10%	0.19	-0.04	4.13
PERCENT TOOLING SAVINGS	-10%	-0.08	0.02	-1.59
	10%	0.08	-0.02	1.59
PERCENT LABOR SAVINGS	-10%	-0.26	0.06	-5.71
	10%	0.26	-0.03	5.71
PERCENT MATERIAL SAVINGS	-10%	-0.06	0.01	-1.27
	10%	0.06	-0.01	1.27
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.02	0.00	-0.32
	10%	0.02	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.06	0.01	-1.27
	10%	0.06	-0.01	1.27
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.18	-0.08	11.11
	10%	-0.17	0.03	-9.52
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.53	-0.06	4.76
	10%	-0.45	0.06	-4.44
VALUE OF MACHINED PARTS	-10%	-0.60	0.14	-13.65
	10%	0.60	-0.11	13.33
VALUE OF WIPI	-10%	-0.06	0.01	-1.27
	10%	0.06	-0.01	1.27
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.17	0.04	-3.81
	10%	0.17	-0.03	3.81
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.05	0.01	-0.95
	10%	0.05	-0.01	1.11
ORIGINAL PERCENT LABOR COSTS	-10%	-0.14	0.03	-3.17
	10%	0.14	-0.03	3.17
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.07	-0.01	1.59
	10%	-0.07	0.02	-1.59
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.49	-0.09	10.79
	10%	-0.49	0.12	-11.11

YEARLY CASH FLOW FOR CASE NUMBER 33

LG/HIGH SIM PARTS (CASE 13 BUT W/UTTC PPI) -- CYL PARTS -- SYS 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	33.	80.	40.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-153.	-92.	-88.
2	20.	100.	40.	30.	135.	60.	6.	54.	22.	75.	18.	6.	18.	9.	1.	-191.	-103.	-177.
3	10.	80.	0.	20.	135.	90.	30.	270.	112.	375.	90.	30.	90.	10.	1.	632.	330.	83.
4	0.	0.	0.	0.	135.	90.	66.	594.	247.	825.	198.	66.	198.	9.	0.	1903.	994.	795.
5	0.	0.	0.	0.	135.	90.	77.	693.	289.	962.	231.	77.	231.	8.	0.	2258.	1178.	1562.
6	0.	0.	0.	0.	135.	90.	84.	756.	315.	1050.	252.	84.	252.	7.	0.	2484.	1296.	2329.
7	0.	0.	0.	0.	135.	90.	88.	792.	330.	1100.	264.	88.	264.	5.	0.	2613.	1361.	3061.
8	0.	0.	0.	0.	135.	90.	90.	810.	337.	1123.	270.	90.	270.	4.	0.	2677.	1394.	3743.
9	0.	0.	0.	0.	135.	90.	90.	810.	337.	1123.	270.	90.	270.	3.	0.	2677.	1394.	4363.
10	0.	0.	0.	0.	135.	90.	90.	810.	337.	1125.	270.	90.	270.	2.	0.	2677.	1393.	4927.
TOTALS	65.	260.	80.	50.	1215.	780.		5589.	2329.	7762.	1863.	621.	1863.	64.	5.	17577.	9144.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.70
YEARS TO PAYBACK = 2.7
RETURN ON INVESTMENT = 171.7

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 6.89
YEARS TO PAYBACK = 2.7
RETURN ON INVESTMENT = 181.8

INPUT DATA FOR CASE NUMBER 33 LC/HIGH SIM PARTS (CASE 15 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

****

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIPI ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 25.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	33.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	80.0	100.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
UPDATE DATA FILES ($K)	0.0	60.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	6.0	30.0	66.0	77.0	84.0	88.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 32 LG/HIGH SIM PARTS (CASE 14 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.73
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 242.8

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.97	0.06	-20.63
	10%	0.97	-0.05	19.68
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.23	0.01	-5.40
	10%	0.23	-0.01	5.08
PERCENT TOOLING SAVINGS	-10%	-0.07	0.00	-1.90
	10%	0.07	-0.00	1.27
PERCENT LABOR SAVINGS	-10%	-0.37	0.02	-7.93
	10%	0.37	-0.02	7.62
PERCENT MATERIAL SAVINGS	-10%	-0.13	0.01	-2.86
	10%	0.13	-0.01	2.54
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.03	0.00	-0.63
	10%	0.03	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.13	0.01	-2.86
	10%	0.13	-0.01	2.54
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.27	-0.03	17.14
	10%	-0.26	0.03	-14.92
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.76	-0.02	4.13
	10%	-0.66	0.02	-4.44
VALUE OF MACHINED PARTS	-10%	-0.84	0.05	-17.77
	10%	0.84	-0.04	17.14
VALUE OF WIPI	-10%	-0.13	0.01	-2.86
	10%	0.13	-0.01	2.54
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.23	0.01	-5.08
	10%	0.23	-0.01	4.44
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.95
	10%	0.03	-0.00	0.63
ORIGINAL PERCENT LABOR COSTS	-10%	-0.21	0.01	-4.44
	10%	0.21	-0.01	4.13
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.03	-0.00	0.95
	10%	-0.03	0.00	-1.27
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.69	-0.03	13.96
	10%	-0.69	0.04	-14.60

YEARLY CASH FLOW FOR CASE NUMBER 32 LG/HIGH SIM PARTS (CASE 14 BUT W/UTMC PPI) -- CYL PARTS -- SYS 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP1 SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	40.	12.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-107.	-67.	-64.
2	20.	40.	12.	20.	75.	22.	9.	54.	16.	79.	27.	8.	27.	9.	1.	10.	6.	-59.
3	10.	0.	0.	0.	75.	45.	39.	234.	68.	341.	117.	23.	117.	10.	1.	771.	482.	259.
4	0.	0.	0.	0.	75.	45.	75.	459.	134.	656.	225.	45.	225.	9.	0.	1612.	843.	862.
5	0.	0.	0.	0.	75.	45.	85.	510.	149.	744.	255.	51.	255.	8.	0.	1843.	962.	1481.
6	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	7.	0.	1939.	1022.	2093.
7	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	5.	0.	1939.	1021.	2643.
8	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	4.	0.	1939.	1021.	3142.
9	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	3.	0.	1939.	1020.	3596.
10	0.	0.	0.	0.	75.	45.	90.	540.	157.	787.	270.	54.	270.	2.	0.	1939.	1020.	4009.
TOTALS	65.	80.	24.	40.	675.	382.		3948.	1151.	5757.	1974.	395.	1974.	64.	5.	13933.	7249.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 9.73
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 242.8

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 10.30
YEARS TO PAYBACK = 2.2
RETURN ON INVESTMENT = 269.8

INPUT DATA FOR CASE NUMBER 32 LG/HIGH SIM PARTS (CASE 14 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

ANNUAL VALUE OF PARTS ($K) = 50000.0 ANNUAL VALUE OF WIP1 ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 23.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIP1	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
UPDATE DATA FILES ($K)	0.0	22.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	9.0	39.0	75.0	85.0	90.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 31 — LC/HIGH SIM PARTS (CASE 13 BUT W/UTHC PPI) -- CYL PARTS -- SYS 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 15.49
YEARS TO PAYBACK = 2.0
RETURN ON INVESTMENT = 317.4

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-1.55	0.04	-25.07
	10%	1.53	-0.13	24.44
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.36	0.02	-5.71
	10%	0.36	-0.04	6.03
PERCENT TOOLING SAVINGS	-10%	-0.12	0.01	-1.90
	10%	0.12	-0.01	1.90
PERCENT LABOR SAVINGS	-10%	-0.60	0.02	-9.84
	10%	0.60	-0.06	9.84
PERCENT MATERIAL SAVINGS	-10%	-0.29	0.02	-4.76
	10%	0.29	-0.03	4.76
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
PERCENT WIPI SAVINGS	-10%	-0.14	0.01	-2.22
	10%	0.14	-0.02	2.22
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.24	-0.08	16.19
	10%	-0.23	0.02	-14.28
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	1.43	-0.09	9.84
	10%	-1.27	0.03	-9.20
VALUE OF MACHINED PARTS	-10%	-1.40	0.04	-22.53
	10%	1.40	-0.14	22.22
VALUE OF WIPI	-10%	-0.14	0.01	-2.22
	10%	0.14	-0.02	2.22
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.33	0.02	-5.40
	10%	0.33	-0.04	5.40
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.01	-0.95
	10%	0.03	-0.01	0.95
ORIGINAL PERCENT LABOR COSTS	-10%	-0.34	0.02	-5.40
	10%	0.34	-0.04	5.40
ORIGINAL PERCENT MATERIAL COSTS	-10%	-0.01	0.00	-0.32
	10%	0.01	-0.00	0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	1.13	-0.11	18.09
	10%	-1.13	0.03	-18.41

YEARLY CASH FLOW FOR CASE NUMBER 31

LG/HIGH SIM PARTS (CASE 13 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	40.	6.	10.	18.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-74.	-38.	-37.
2	0.	0.	6.	0.	36.	20.	9.	34.	11.	56.	27.	3.	14.	0.	0.	82.	43.	0.
3	0.	0.	0.	0.	36.	20.	39.	145.	49.	244.	117.	12.	59.	0.	0.	570.	296.	238.
4	0.	0.	0.	0.	36.	20.	75.	281.	94.	469.	225.	22.	113.	0.	0.	1148.	597.	662.
5	0.	0.	0.	0.	36.	20.	85.	319.	106.	531.	255.	25.	128.	0.	0.	1308.	680.	1105.
6	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	135.	0.	0.	1388.	722.	1532.
7	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	133.	0.	0.	1388.	722.	1921.
8	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	133.	0.	0.	1388.	722.	2274.
9	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	133.	0.	0.	1388.	722.	2595.
10	0.	0.	0.	0.	36.	20.	90.	337.	112.	562.	270.	27.	133.	0.	0.	1388.	722.	2887.
TOTALS	0.	40.	12.	10.	342.	180.		2467.	822.	4112.	1974.	197.	987.	0.	0.	9977.	5188.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 15.49
YEARS TO PAYBACK = 2.0
RETURN ON INVESTMENT = 317.4

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 15.49
YEARS TO PAYBACK = 2.0
RETURN ON INVESTMENT = 317.4

INPUT DATA FOR CASE NUMBER 31
****

LG/HIGH SIM PARTS (CASE 13 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

ANNUAL VALUE OF PARTS ($K) = 50000.0 , ANNUAL VALUE OF WIPI ($K) = 25000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 3.0%	TOOLING	= 5.0%
DIRECT LABOR	= 23.0%	MATERIAL	= 20.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIPI	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	10.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
UPDATE DATA FILES ($K)	0.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	9.0	39.0	75.0	83.0	90.0	90.0	90.0	90.0	90.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 30 MED/SIM PARTS (CASE 9 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.92
YEARS TO PAYBACK = 5.0
RETURN ON INVESTMENT = 46.2

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.19	0.40	-6.35
	10%	0.19	-0.33	6.03
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.07	0.15	-2.54
	10%	0.07	-0.14	2.38
PERCENT TOOLING SAVINGS	-10%	-0.03	0.03	-0.95
	10%	0.03	-0.03	0.79
PERCENT LABOR SAVINGS	-10%	-0.05	0.10	-1.67
	10%	0.05	-0.10	1.59
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.40
	10%	0.01	-0.02	0.32
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.32
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.02	0.04	-0.63
	10%	0.02	-0.04	0.56
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.05	-0.16	3.17
	10%	-0.05	0.13	-2.06
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.14	-0.20	3.17
	10%	-0.12	0.21	-3.17
VALUE OF MACHINED PARTS	-10%	-0.17	0.36	-5.71
	10%	0.17	-0.30	5.40
VALUE OF WIPI	-10%	-0.02	0.04	-0.63
	10%	0.02	-0.04	0.56
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.07	0.14	-2.38
	10%	0.07	-0.13	2.22
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.03	-0.34
	10%	0.02	-0.03	0.48
ORIGINAL PERCENT LABOR COSTS	-10%	-0.02	0.04	-0.63
	10%	0.02	-0.04	0.63
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.03	0.48
	10%	-0.02	0.03	-0.63
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.01	0.00	-0.16
	10%	0.00	-0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.17	-0.30	5.40
	10%	-0.17	0.36	-5.71

YEARLY CASH FLOW FOR CASE NUMBER 30 MED/SIM PARTS (CASE 9 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	60.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-115.	-71.	-68.
2	10.	80.	20.	40.	90.	30.	8.	24.	8.	16.	4.	2.	6.	8.	1.	-210.	-110.	-163.
3	10.	60.	0.	20.	90.	60.	24.	72.	25.	48.	11.	7.	17.	9.	1.	-60.	-31.	-187.
4	0.	0.	0.	0.	90.	60.	50.	150.	52.	100.	22.	15.	36.	8.	0.	226.	121.	-101.
5	0.	0.	0.	0.	90.	60.	60.	180.	63.	120.	27.	18.	43.	7.	0.	301.	160.	4.
6	0.	0.	0.	0.	90.	60.	68.	204.	71.	136.	31.	20.	49.	6.	0.	361.	191.	116.
7	0.	0.	0.	0.	90.	60.	75.	225.	79.	150.	34.	22.	54.	5.	0.	414.	217.	204.
8	0.	0.	0.	0.	90.	60.	80.	240.	84.	160.	36.	24.	58.	4.	0.	452.	237.	349.
9	0.	0.	0.	0.	90.	60.	80.	240.	84.	160.	36.	24.	58.	3.	0.	452.	236.	454.
10	0.	0.	0.	0.	90.	60.	80.	240.	84.	160.	36.	24.	58.	2.	0.	452.	236.	549.
TOTALS	55.	200.	40.	60.	810.	510.		1575.	551.	1050.	236.	158.	378.	54.	4.	2273.	1183.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.92
YEARS TO PAYBACK = 5.0
RETURN ON INVESTMENT = 46.2

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 1.96
YEARS TO PAYBACK = 5.0
RETURN ON INVESTMENT = 48.1

INPUT DATA FOR CASE NUMBER 30 MED/SIM PARTS (CASE 9 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3
****

ANNUAL VALUE OF PARTS ($K) = 10000.0 ANNUAL VALUE OF WIPI ($K) = 6000.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 5.0%	TOOLING	= 7.0%
DIRECT LABOR	= 20.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 3.0%	OVERHEAD, FEE, ETC	= 30.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	35.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	60.0	80.0	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	40.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
UPDATE DATA FILES ($K)	0.0	30.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	8.0	24.0	50.0	60.0	68.0	75.0	80.0	80.0	80.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 29 MED/SIM PARTS (CASE 8 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.02
YEARS TO PAYBACK = 3.6
RETURN ON INVESTMENT = 77.6

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.27	0.21	-8.23
	10%	0.27	-0.16	7.93
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.10	0.07	-3.02
	10%	0.10	-0.07	3.02
PERCENT TOOLING SAVINGS	-10%	-0.03	0.02	-0.79
	10%	0.03	-0.02	0.79
PERCENT LABOR SAVINGS	-10%	-0.07	0.05	-2.06
	10%	0.07	-0.05	2.22
PERCENT MATERIAL SAVINGS	-10%	-0.02	0.02	-0.63
	10%	0.02	-0.02	0.79
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.32
PERCENT WIPI SAVINGS	-10%	-0.04	0.03	-1.11
	10%	0.04	-0.02	1.11
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.03	-0.09	5.24
	10%	-0.07	0.09	-4.44
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.21	-0.09	3.35
	10%	-0.19	0.09	-3.1[illegible]
VALUE OF MACHINED PARTS	-10%	-0.24	0.18	-6.98
	10%	0.24	-0.14	6.82
VALUE OF WIPI	-10%	-0.04	0.03	-1.11
	10%	0.04	-0.02	1.11
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.10	0.07	-2.86
	10%	0.10	-0.06	2.86
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.01	-0.32
	10%	0.01	-0.01	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.03	0.02	-0.95
	10%	0.03	-0.02	0.95
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.01	0.48
	10%	-0.01	0.01	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.16
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.24	-0.14	6.82
	10%	-0.24	0.18	-6.98

YEARLY CASH FLOW FOR CASE NUMBER 29 MED/SIM PARTS (CASE 8 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	35.	30.	6.	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	2.	-81.	-53.	-51.
2	10.	30.	6.	10.	45.	18.	12.	24.	6.	17.	5.	2.	9.	8.	1.	-56.	-30.	-77.
3	10.	0.	0.	0.	45.	36.	31.	62.	15.	43.	14.	6.	22.	7.	1.	71.	37.	-47.
4	0.	0.	0.	0.	45.	36.	58.	116.	28.	81.	26.	10.	42.	6.	0.	223.	120.	33.
5	0.	0.	0.	0.	45.	36.	70.	140.	34.	98.	31.	13.	50.	7.	0.	286.	152.	137.
6	0.	0.	0.	0.	45.	36.	80.	160.	39.	112.	36.	14.	58.	6.	0.	338.	179.	243.
7	0.	0.	0.	0.	45.	36.	80.	160.	39.	112.	36.	14.	58.	5.	0.	338.	178.	339.
8	0.	0.	0.	0.	45.	36.	80.	160.	39.	112.	36.	14.	58.	4.	0.	338.	178.	423.
9	0.	0.	0.	0.	45.	36.	80.	160.	39.	112.	36.	14.	58.	3.	0.	338.	177.	504.
10	0.	0.	0.	0.	45.	36.	80.	160.	39.	112.	36.	14.	58.	2.	0.	338.	177.	575.
TOTALS	55.	60.	12.	20.	405.	306.		1142.	280.	799.	237.	103.	411.	54.	4.	2134.	1113.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.82
YEARS TO PAYBACK = 3.6
RETURN ON INVESTMENT = 77.6

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.97
YEARS TO PAYBACK = 3.6
RETURN ON INVESTMENT = 88.7

INPUT DATA FOR CASE NUMBER 34 SM/RICH SIM PARTS (CASE 19 BUT W/UTRC PP1) -- CYL PARTS -- SYS 1

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIP1 ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 25.0%	TOOLING	= 5.0%
DIRECT LABOR	= 5.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 3.0%	WIP1	= 2.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
UPDATE DATA FILES ($K)	0.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	9.0	39.0	75.0	83.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 34

SM/HIGH SIM PARTS (CASE 19 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	0.	10.	3.	5.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	-21.	-11.	-10.
2	0.	0.	0.	0.	6.	4.	9.	3.	2.	6.	2.	0.	1.	0.	0.	6.	3.	-8.
3	0.	0.	0.	0.	6.	4.	39.	19.	7.	26.	9.	1.	6.	0.	0.	30.	30.	16.
4	0.	0.	0.	0.	6.	4.	75.	37.	13.	51.	17.	2.	11.	0.	0.	123.	63.	61.
5	0.	0.	0.	0.	6.	4.	83.	42.	15.	57.	19.	3.	13.	0.	0.	139.	72.	109.
6	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	154.
7	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	196.
8	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	233.
9	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	267.
10	0.	0.	0.	0.	6.	4.	90.	45.	16.	61.	20.	3.	14.	0.	0.	148.	77.	299.
TOTALS	0.	10.	3.	5.	57.	36.		329.	115.	444.	148.	20.	99.	0.	0.	1044.	543.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.66
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 168.0

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.66
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 168.0

SENSITIVITY ANALYSIS FOR CASE NUMBER 34 SH/HIGH SIM PARTS (CASE 19 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 8.66
YEARS TO PAYBACK = 2.3
RETURN ON INVESTMENT = 168.0

	CHANGE	.. NET CHANGES IN ... BCR	VTP	ROI
PERCENT OF PARTS IMPACTED	-10%	-0.07	0.00	-12.05
	10%	0.07	-0.06	12.35
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.23	0.02	-3.65
	10%	0.23	-0.02	3.65
PERCENT TOOLING SAVINGS	-10%	-0.09	0.01	-1.11
	10%	0.09	-0.01	1.27
PERCENT LABOR SAVINGS	-10%	-0.33	0.03	-4.92
	10%	0.33	-0.02	4.92
PERCENT MATERIAL SAVINGS	-10%	-0.11	0.01	-1.59
	10%	0.11	-0.01	1.73
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
PERCENT WIPI SAVINGS	-10%	-0.07	0.01	-1.11
	10%	0.07	-0.01	1.11
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.20	-0.04	9.05
	10%	-0.19	0.04	-7.78
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.72	-0.03	4.28
	10%	-0.62	0.03	-3.97
VALUE OF MACHINED PARTS	-10%	-0.79	0.07	-11.56
	10%	0.79	-0.06	11.27
VALUE OF WIPI	-10%	-0.07	0.01	-1.11
	10%	0.07	-0.01	1.11
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.22	0.02	-3.33
	10%	0.22	-0.02	3.33
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.03	0.00	-0.48
	10%	0.03	-0.00	0.48
ORIGINAL PERCENT LABOR COSTS	-10%	-0.16	0.01	-2.38
	10%	0.16	-0.01	2.38
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.01	-0.00	0.16
	10%	-0.01	0.00	-0.16
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	0.00	-0.00	0.16
	10%	-0.00	0.00	0.00
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.63	-0.03	9.36
	10%	-0.63	0.06	-9.32

INPUT DATA FOR CASE NUMBER 33 SM/HIGH SIM PARTS (CASE 20 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

****

ANNUAL VALUE OF PARTS ($K) = 5000.0 ANNUAL VALUE OF WIPI ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 13.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 43.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 40.0%	TOOLING	= 7.0%
DIRECT LABOR	= 7.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 6.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	23.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	6.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
UPDATE DATA FILES ($K)	0.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	9.0	39.0	75.0	85.0	90.0	90.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 35 SM/HIGH SIM PARTS (CASE 20 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIP SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	25.	20.	6.	10.	6.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	-67.	-43.	-41.
2	10.	20.	0.	10.	12.	10.	9.	7.	2.	9.	2.	1.	3.	6.	1.	-39.	-21.	-60.
3	0.	0.	0.	0.	12.	10.	39.	31.	10.	37.	9.	2.	12.	5.	0.	78.	45.	-23.
4	0.	0.	0.	0.	12.	10.	75.	60.	18.	71.	17.	5.	22.	5.	0.	171.	91.	40.
5	0.	0.	0.	0.	12.	10.	85.	68.	21.	80.	19.	5.	26.	4.	0.	197.	104.	109.
6	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	3.	0.	210.	111.	173.
7	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	3.	0.	210.	110.	233.
8	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	2.	0.	210.	110.	287.
9	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	1.	0.	210.	110.	335.
10	0.	0.	0.	0.	12.	10.	90.	72.	22.	85.	20.	5.	27.	1.	0.	210.	109.	380.
TOTALS	35.	40.	6.	20.	114.	90.		626.	161.	622.	148.	39.	197.	35.	2.	1309.	725.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.93
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 76.6

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 4.34
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 84.2

SENSITIVITY ANALYSIS FOR CASE NUMBER 33 SM/HIGH SIM PARTS (CASE 20 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 3.93
YEARS TO PAYBACK = 3.4
RETURN ON INVESTMENT = 76.6

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	*****	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.38	0.14	-6.43
	10%	0.38	-0.11	6.19
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.12	0.04	-1.90
	10%	0.12	-0.04	2.06
PERCENT TOOLING SAVINGS	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.63
PERCENT LABOR SAVINGS	-10%	-0.14	0.05	-2.30
	10%	0.14	-0.04	2.33
PERCENT MATERIAL SAVINGS	-10%	-0.03	0.01	-0.43
	10%	0.03	-0.01	0.63
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.16
PERCENT WIPI SAVINGS	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.79
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.19	-0.05	5.08
	10%	-0.17	0.08	-4.20
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.21	-0.04	1.75
	10%	-0.19	0.04	-1.59
VALUE OF MACHINED PARTS	-10%	-0.34	0.12	-5.71
	10%	0.34	-0.10	5.55
VALUE OF WIPI	-10%	-0.04	0.01	-0.63
	10%	0.04	-0.01	0.79
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.11	0.04	-1.75
	10%	0.11	-0.03	1.90
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.01	0.00	-0.16
	10%	0.01	-0.00	0.32
ORIGINAL PERCENT LABOR COSTS	-10%	-0.07	0.02	-1.11
	10%	0.07	-0.02	1.11
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.01	0.32
	10%	-0.02	0.01	-0.32
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	0.00
	10%	0.00	-0.00	0.08
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.28	-0.08	4.60
	10%	-0.28	0.10	-4.60

INPUT DATA FOR CASE NUMBER 36 SM/HIGH SIM PARTS (CASE 21 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3
****

ANNUAL VALUE OF PARTS ($K) = 3000.0 ANNUAL VALUE OF WIPI ($K) = 2500.0

CURRENT COST COMPONENTS....

PROCESS PLANNING	= 4.0%	TOOLING	= 7.0%
DIRECT LABOR	= 27.0%	MATERIAL	= 15.0%
SCRAP & REWORK	= 2.0%	OVERHEAD, FEE, ETC	= 45.0%

POTENTIAL SAVINGS FOR THIS CASE....

PROCESS PLANNING	= 60.0%	TOOLING	= 15.0%
DIRECT LABOR	= 10.0%	MATERIAL	= 3.0%
SCRAP & REWORK	= 10.0%	WIPI	= 4.0%

YEARLY INPUT....

YEAR	1	2	3	4	5	6	7	8	9	10
HARDWARE COSTS ($K)	25.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESTABLISH DATA FILES ($K)	40.0	60.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAIN PERSONNEL ($K)	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEST SYSTEM ($K)	0.0	20.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMPUTER CHARGES & MAINTENANCE ($K)	0.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
UPDATE DATA FILES ($K)	0.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
PERCENT OF PARTS IMPACTED (%) (BY DOLLAR VALUE)	0.0	6.0	30.0	66.0	77.0	84.0	88.0	90.0	90.0	90.0

YEARLY CASH FLOW FOR CASE NUMBER 36 SM/HIGH SIM PARTS (CASE 21 BUT W/UTHC PPI) -- CYL PARTS -- SYS 3

YEAR	HARDWARE ($K)	ESTABLISH DATA FILES ($K)	TRAIN PERSONNEL ($K)	TEST SYSTEM ($K)	COMPUTER CHARGES & PROGRAM MAINTENANCE ($K)	UPDATING DATA FILES ($K)	PERCENTAGE OF PARTS IMPACTED (%)	PROCESS PLANNING SAVINGS ($K)	TOOLING SAVINGS ($K)	DIRECT LABOR SAVINGS ($K)	MATERIAL SAVINGS ($K)	SCRAP & REWORK COST SAVINGS ($K)	WIPI SAVINGS ($K)	DEPRECIATION ($K)	INVESTMENT TAX CREDIT ($K)	CASH FLOW BEFORE TAXES & DEPRECIATION ($K)	CASH FLOW AFTER TAXES & DEPRECIATION ($K)	CUMULATIVE PRESENT VALUE AFTER TAXES & DEPRECIATION ($K)
1	25.	40.	20.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	2.	-85.	-52.	-50.
2	10.	60.	0.	20.	30.	20.	6.	7.	3.	8.	1.	1.	2.	6.	1.	-118.	-63.	-104.
3	0.	40.	0.	10.	30.	40.	30.	36.	16.	40.	7.	3.	9.	5.	0.	-9.	-2.	-105.
4	0.	0.	0.	0.	30.	40.	66.	79.	35.	89.	15.	7.	20.	5.	0.	174.	93.	-39.
5	0.	0.	0.	0.	30.	40.	77.	92.	40.	104.	17.	8.	23.	4.	0.	215.	114.	33.
6	0.	0.	0.	0.	30.	40.	84.	101.	44.	113.	19.	8.	23.	3.	0.	241.	127.	110.
7	0.	0.	0.	0.	30.	40.	88.	106.	46.	119.	20.	9.	26.	3.	0.	256.	134.	182.
8	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	2.	0.	263.	138.	250.
9	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	1.	0.	263.	137.	311.
10	0.	0.	0.	0.	30.	40.	90.	108.	47.	121.	20.	9.	27.	1.	0.	263.	137.	366.
TOTALS	33.	140.	20.	30.	270.	340.		745.	326.	838.	140.	62.	186.	35.	2.	1463.	763.	

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.18
YEARS TO PAYBACK = 4.5
RETURN ON INVESTMENT = 50.2

FOR 10% ANNUAL DISCOUNT FACTOR BEFORE TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.25
YEARS TO PAYBACK = 4.5
RETURN ON INVESTMENT = 53.7

SENSITIVITY ANALYSIS FOR CASE NUMBER 36 — S'T'HIGH SIM PARTS (CASE 21 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

FOR 10% ANNUAL DISCOUNT FACTOR AFTER TAXES AND DEPRECIATION....
BENEFIT-TO-COST RATIO = 2.18
YEARS TO PAYBACK = 4.5
RETURN ON INVESTMENT = 30.2

	CHANGE	.. NET CHANGES IN ... BCR	YTP	ROI
	******	*****	*****	*****
PERCENT OF PARTS IMPACTED	-10%	-0.21	0.31	-5.93
	10%	0.21	-0.24	5.63
PERCENT PROCESS PLANNING SAVINGS	-10%	-0.07	0.09	-1.02
	10%	0.07	-0.08	1.02
PERCENT TOOLING SAVINGS	-10%	-0.03	0.04	-0.87
	10%	0.03	-0.04	0.79
PERCENT LABOR SAVINGS	-10%	-0.08	0.10	-2.14
	10%	0.09	-0.09	2.06
PERCENT MATERIAL SAVINGS	-10%	-0.01	0.02	-0.48
	10%	0.01	-0.02	0.40
PERCENT SCRAP & REWORK SAVINGS	-10%	-0.01	0.01	-0.16
	10%	0.01	-0.01	0.16
PERCENT WIPI SAVINGS	-10%	-0.02	0.02	-0.48
	10%	0.02	-0.02	0.40
IMPLEMENTATION COSTS (HARDWARE, ESTABLISH FILES, TEST, TRAIN)	-10%	0.08	-0.15	3.65
	10%	-0.08	0.13	-3.25
RECURRING COSTS (COMPUTER CHARGES, MAINTENANCE, UPDATING FILES)	-10%	0.14	-0.12	2.30
	10%	-0.13	0.13	-2.30
VALUE OF MACHINED PARTS	-10%	-0.20	0.28	-5.40
	10%	0.20	-0.22	5.16
VALUE OF WIPI	-10%	-0.02	0.02	-0.48
	10%	0.02	-0.02	0.40
ORIGINAL PERCENT PROCESS PLANNING COSTS	-10%	-0.06	0.08	-1.75
	10%	0.06	-0.08	1.67
ORIGINAL PERCENT TOOLING COSTS	-10%	-0.02	0.02	-0.48
	10%	0.02	-0.02	0.48
ORIGINAL PERCENT LABOR COSTS	-10%	-0.03	0.04	-0.87
	10%	0.03	-0.04	0.87
ORIGINAL PERCENT MATERIAL COSTS	-10%	0.02	-0.02	0.56
	10%	-0.02	0.02	-0.56
ORIGINAL PERCENT SCRAP AND REWORK COSTS	-10%	-0.00	0.00	-0.08
	10%	0.00	-0.00	0.08
ORIGINAL OTHER OTHER COSTS (OVERHEAD, FEE, ETC.)	-10%	0.16	-0.18	4.21
	10%	-0.16	0.22	-4.36

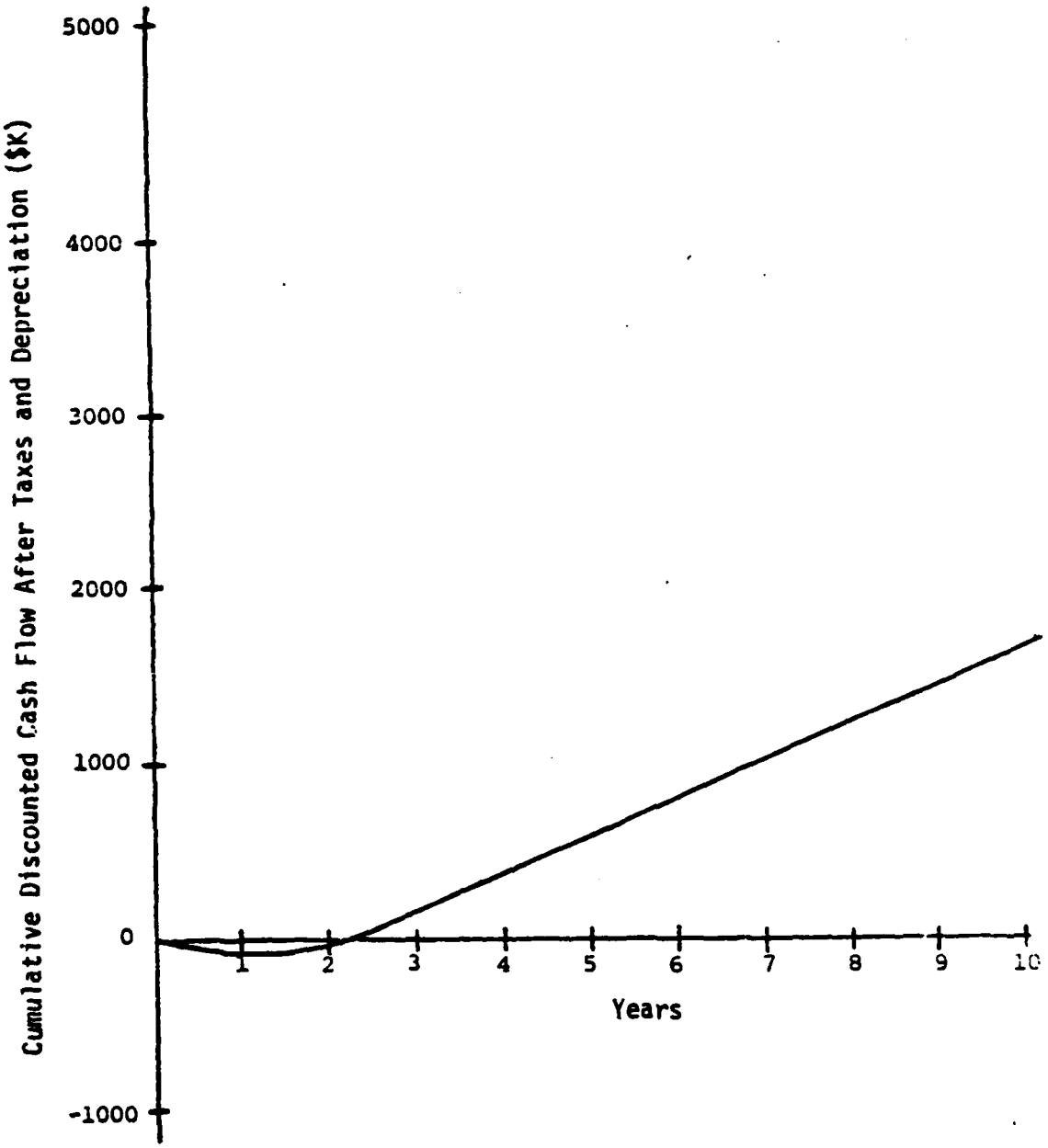
APPENDIX F

PLOTS OF CUMULATIVE PRESENT VALUES BY YEAR FOR EACH CASE

This appendix contains plots of the cumulative discounted cash flows versus year for each of the 36 cases analyzed. The curves represent the values contained in column 19 of the cash flow printouts in Appendix E.

Case No. 1 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 1

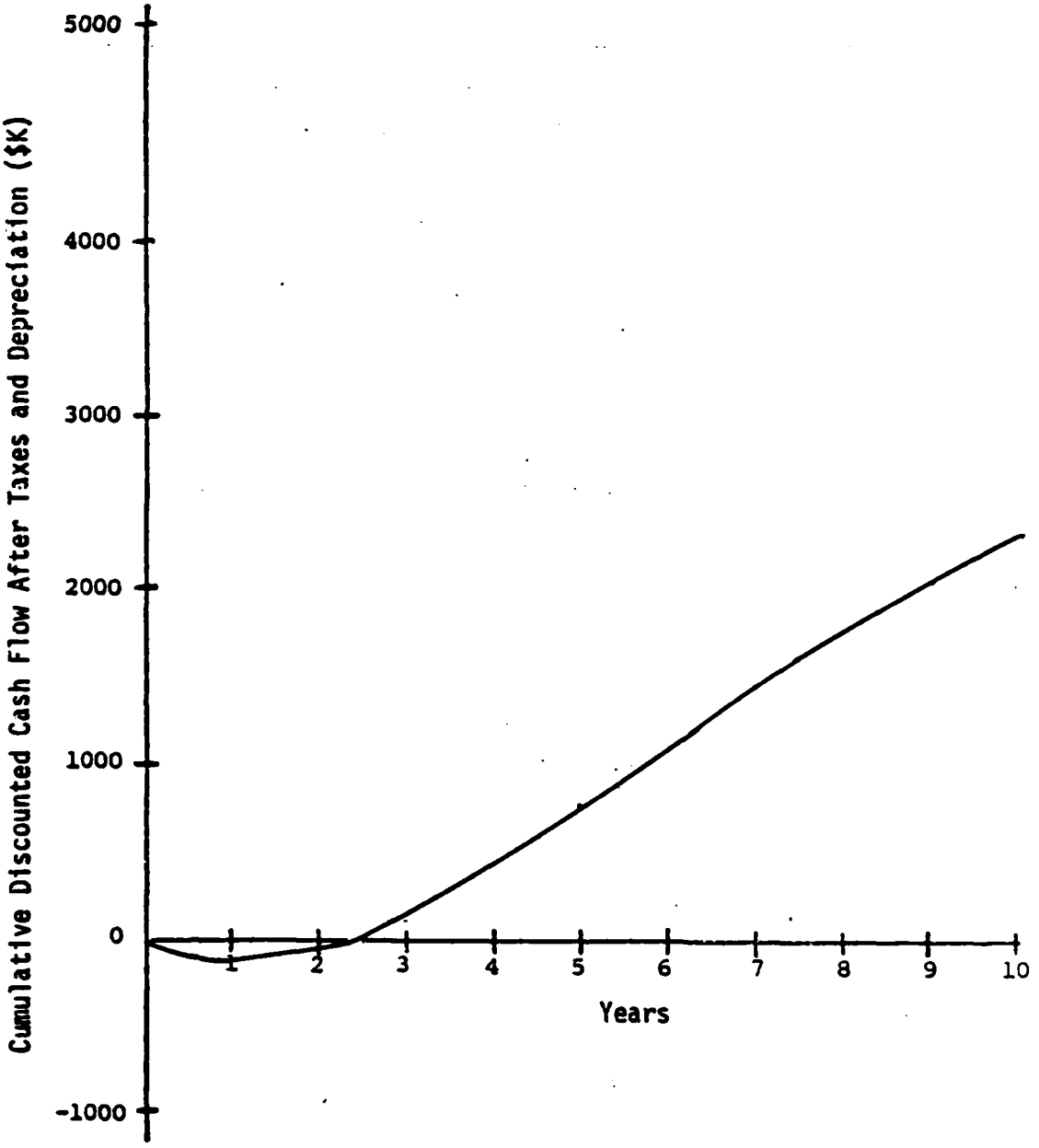
BCR = 10.69 YTP = 2.1 ROI = 196.1%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 1

Case No. 2 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 2

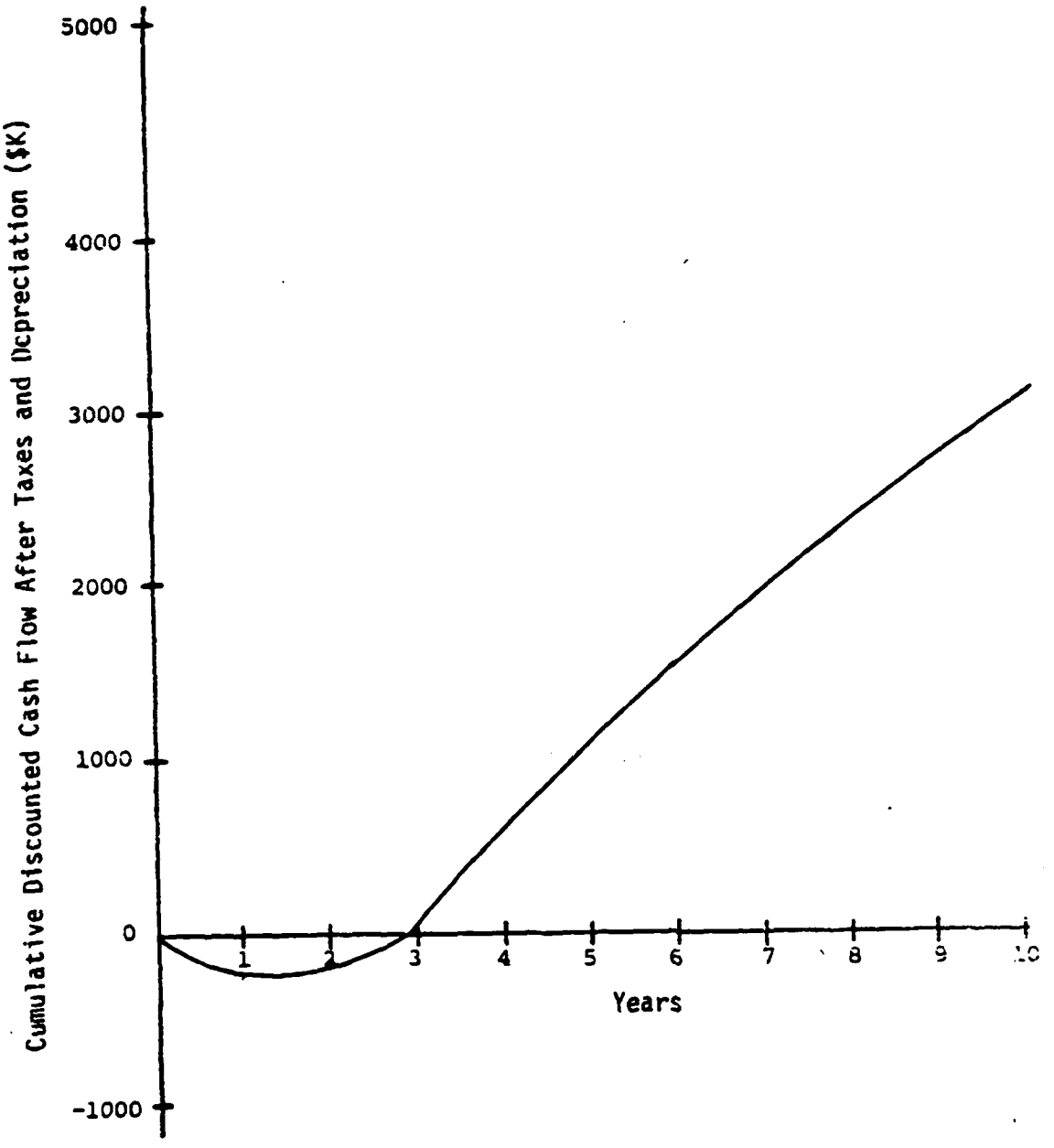
BCR = 7.75 YTP = 2.5 ROI = 122.5%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 2

Case No. 3 COMPOSITE DATA -- CYLINDRICAL PARTS -- SYSTEM 3

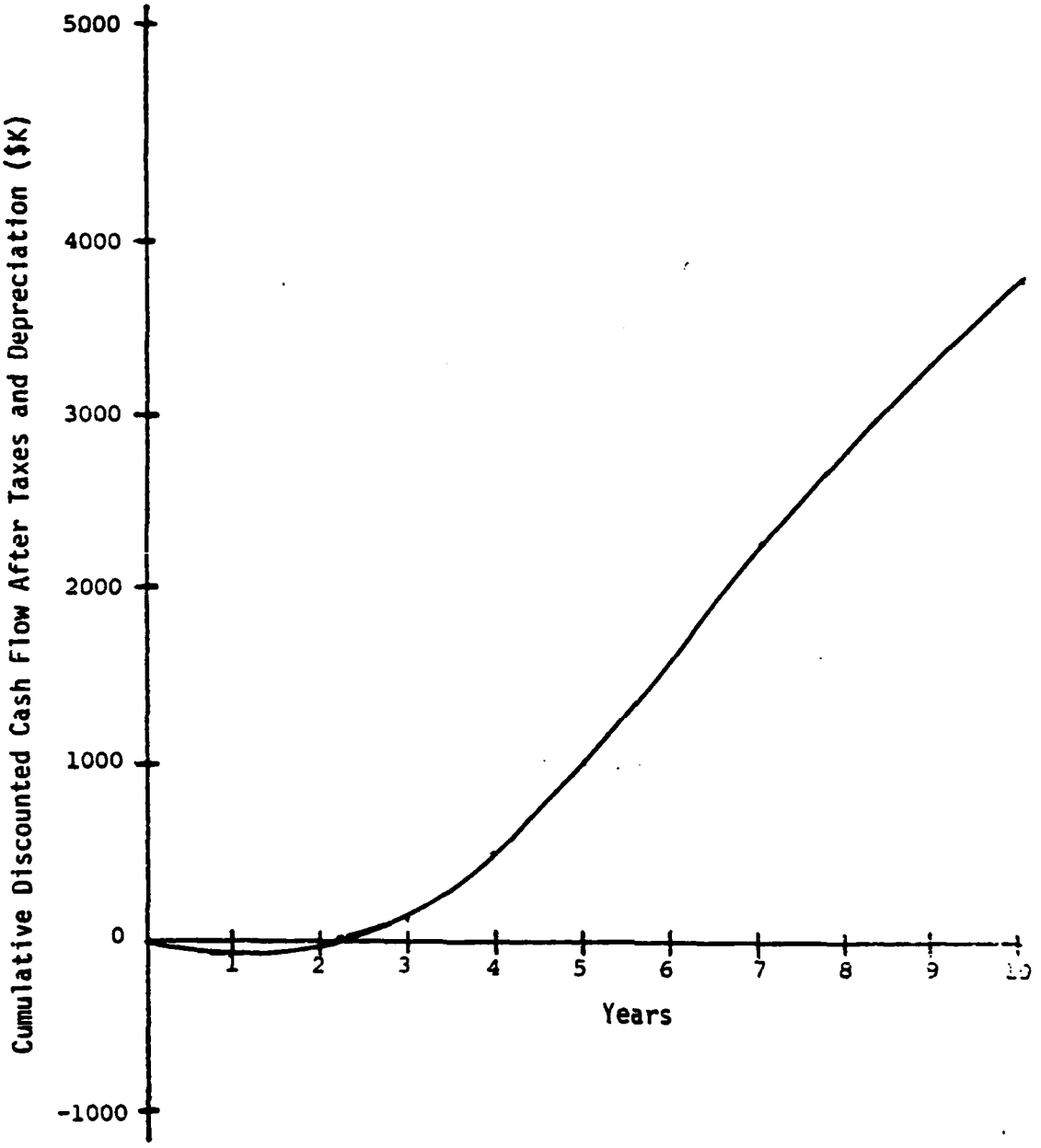
BCR = 5.86 YTP = 2.9 ROI = 101.4%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 3

Case No. 17 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

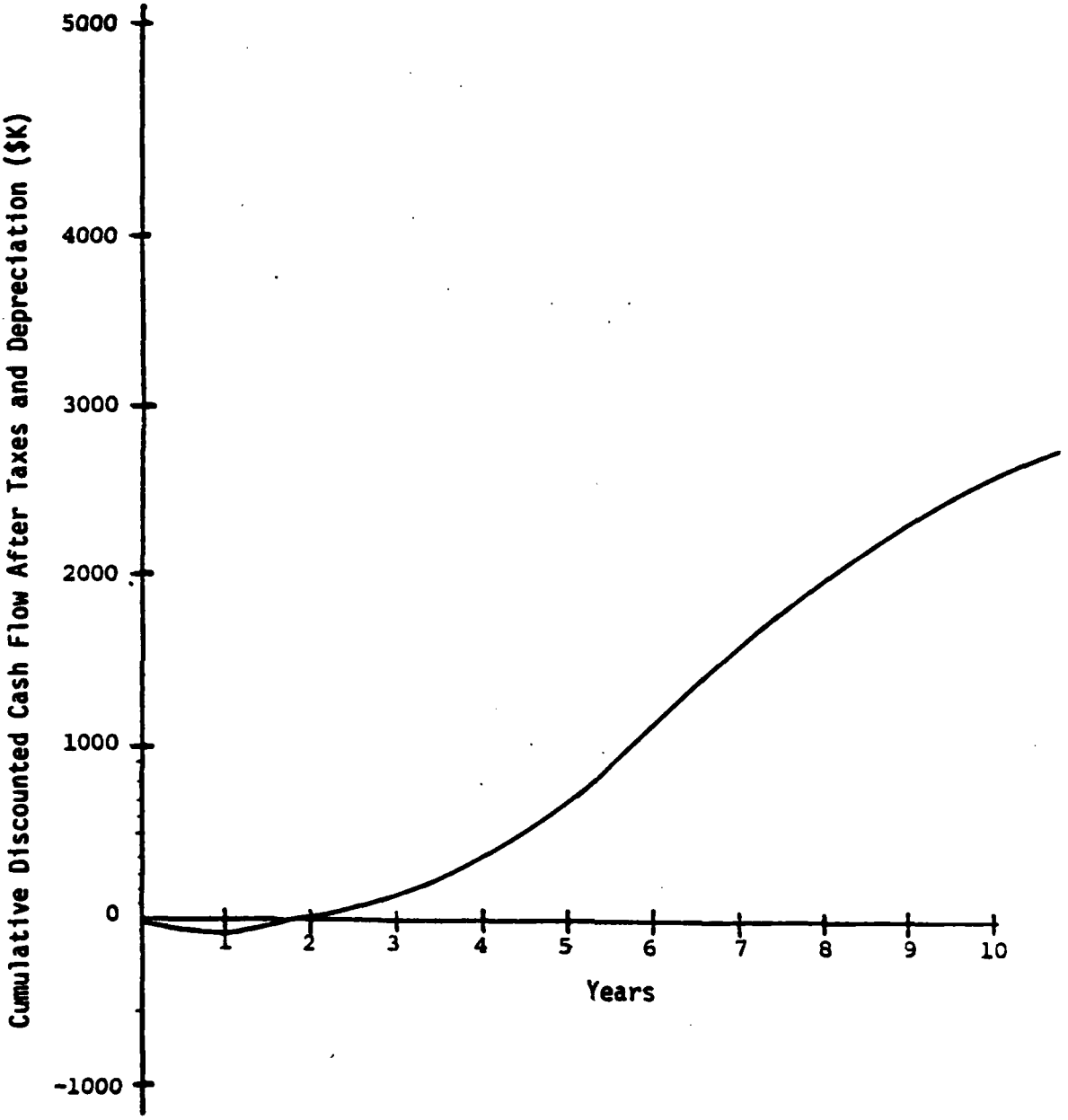
BCR = 9.24 YTP = 2.2 ROI = 201.8%



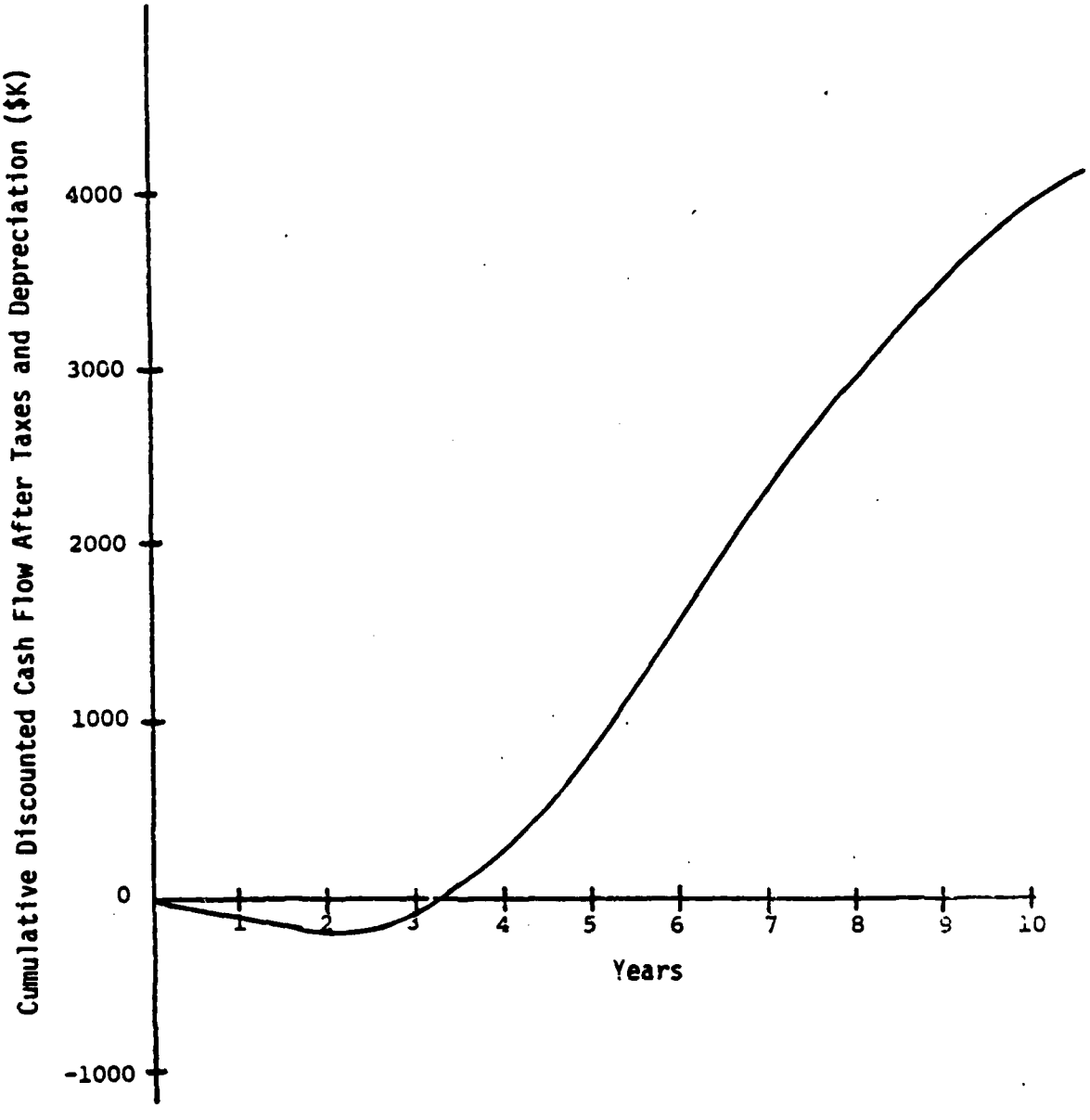
Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 17

Case No. 16 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

BCR = 13.91 **YTP** = 1.9 **ROI** = 241.2%



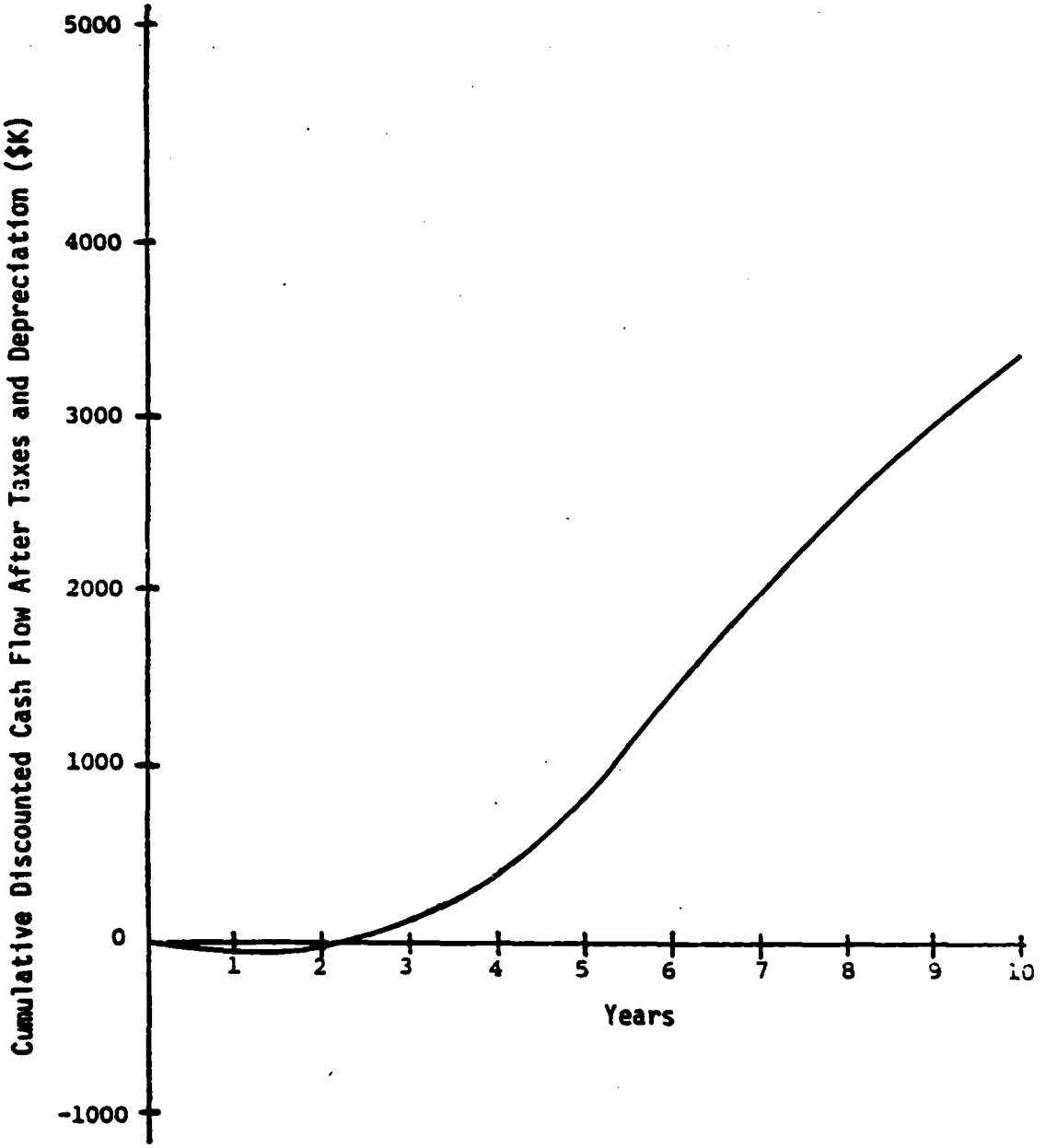
Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 16



Plot of Cumulative Discounted Cash Flow Versus
Year for Case Number 15

Case No. 14 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

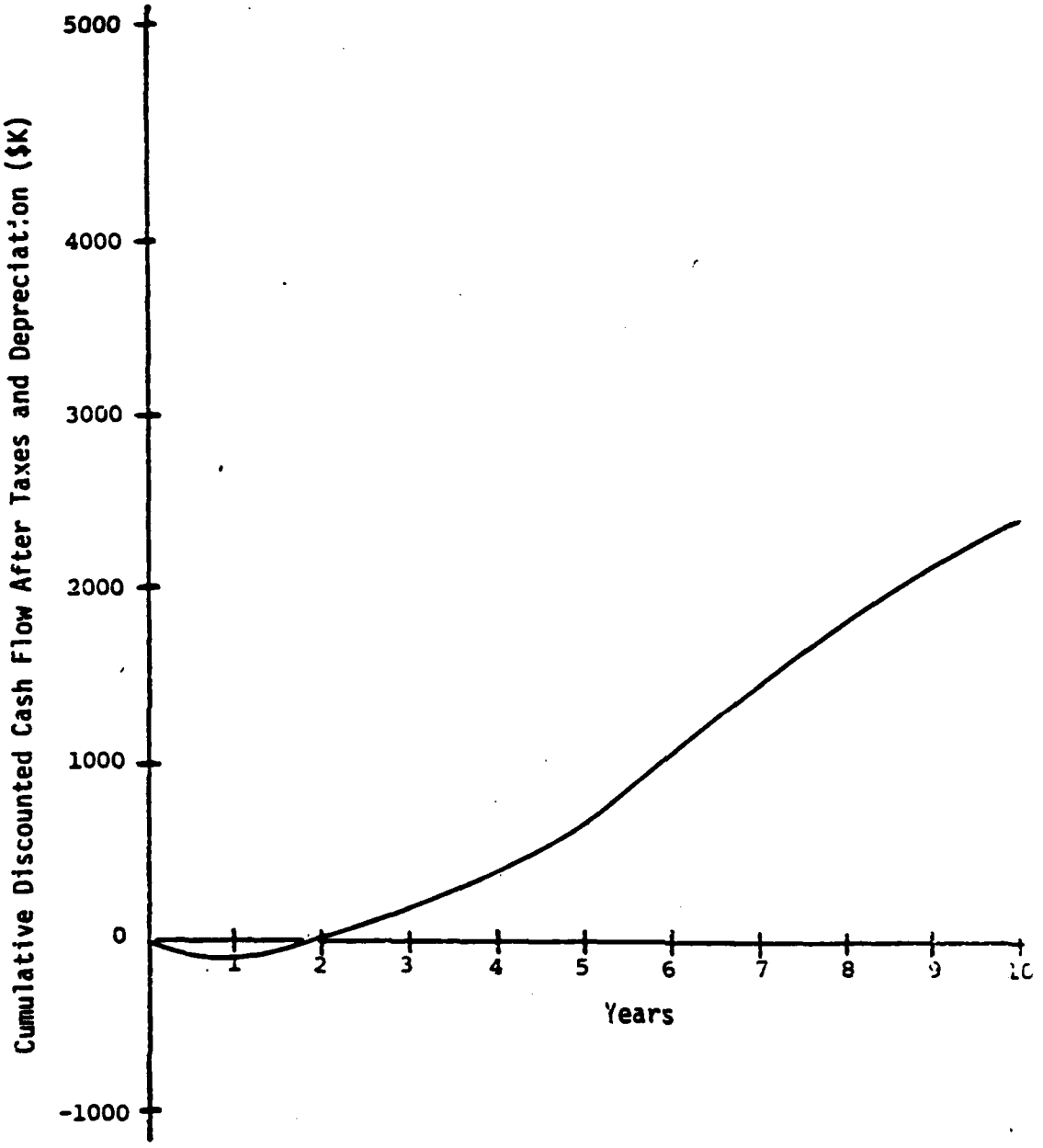
BCR = 8.47 **YTP** = 2.3 **ROI** = 193.3%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 14

Case No. 13 LARGE/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

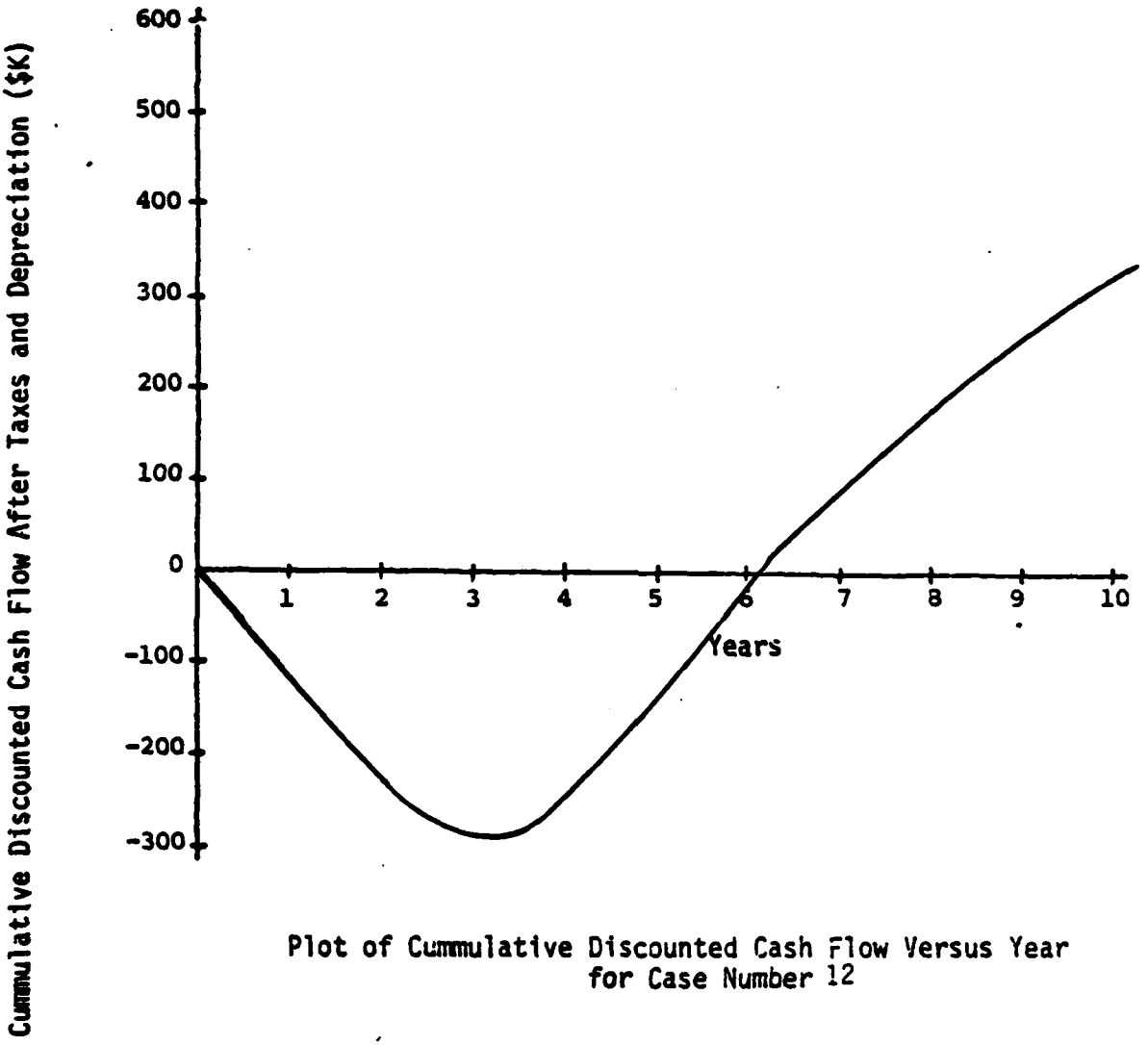
BCR = 13.47 **YTP** = 1.8 **ROI** = 263.7%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number

Case No. 12 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

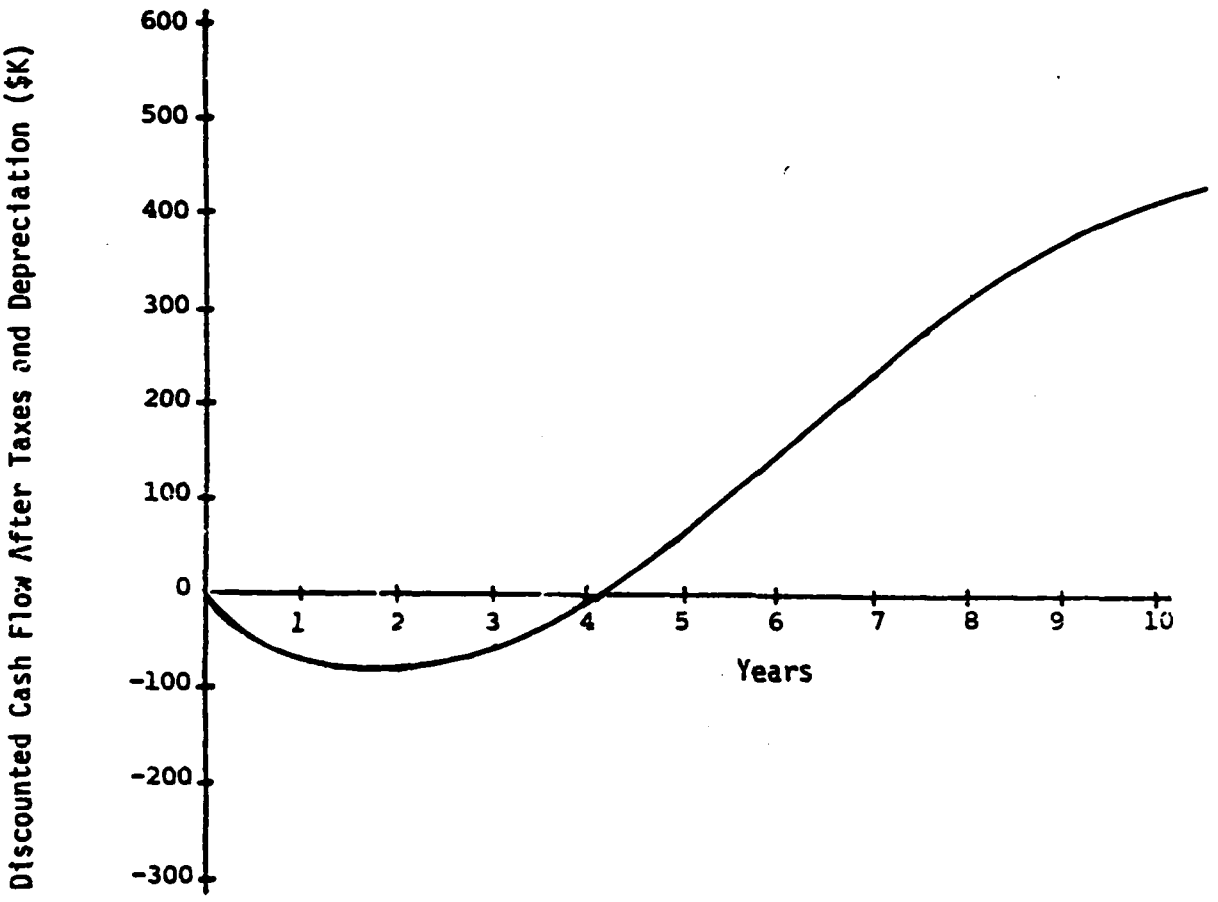
BCR = 1.49 **YTP** = 6.1 **ROI** = 28.8%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 12

Case No. 11 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

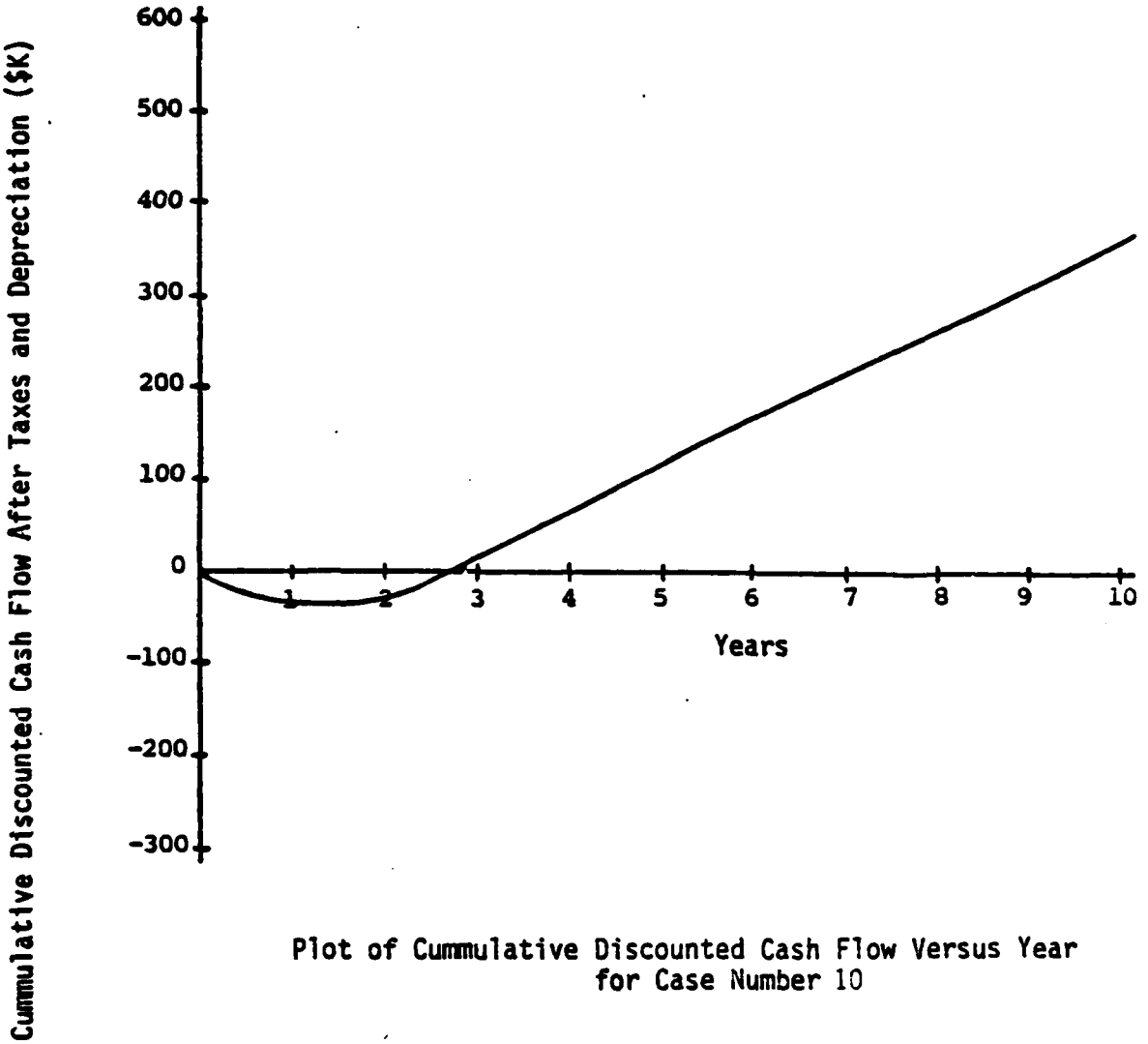
BCR = 2.31 **YTP** = 4.1 **ROI** = 61.1%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 11

Case No. 10 MEDIUM/SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

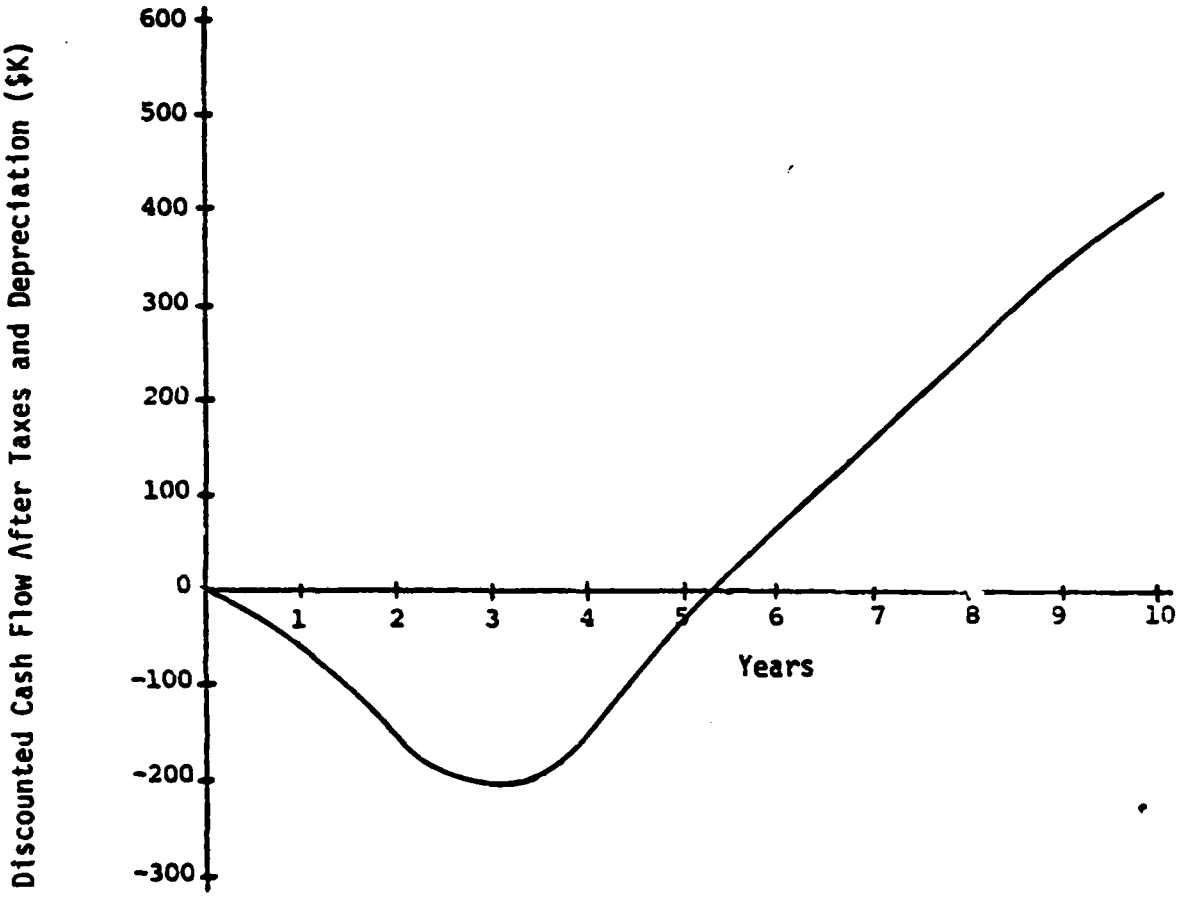
BCR = 4.51 **YTP** = 2.8 **ROI** = 109.2%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 10

Case No. 9 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

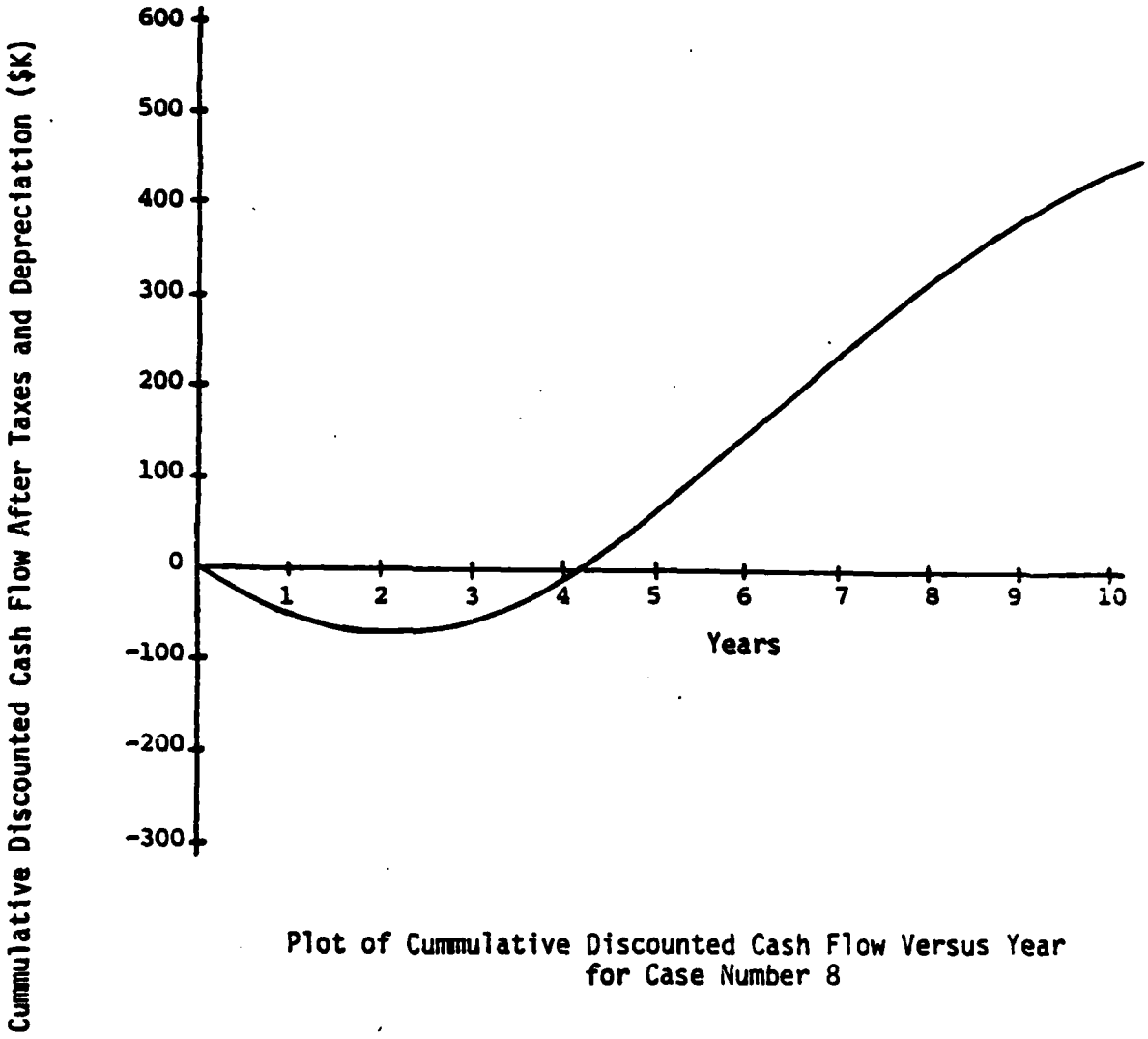
BCR = 1.71 **YTP** = 5.5 **ROI** = 37.9%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 9

Case No. 8 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

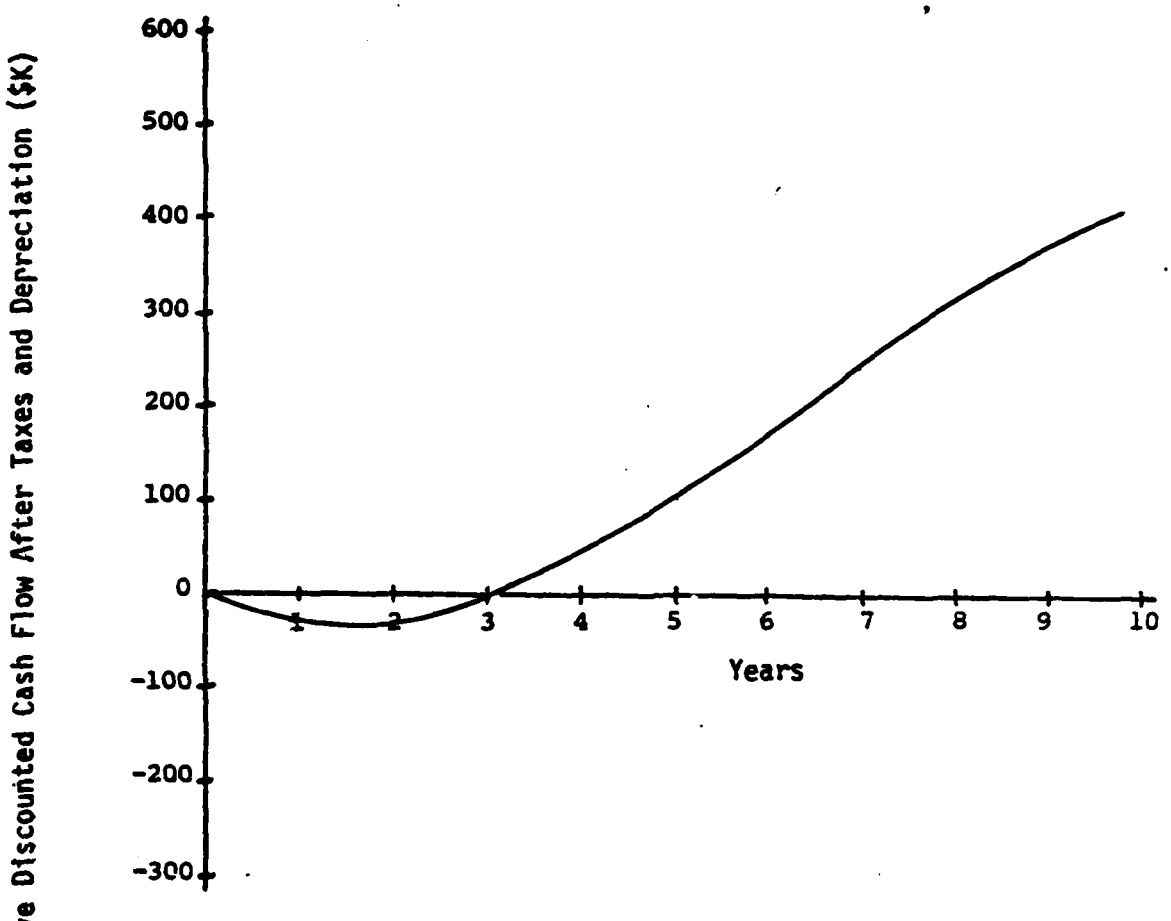
BCR = 2.41 YTP = 4.2 ROI = 62.8%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 8

Case No. 7 MEDIUM/SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

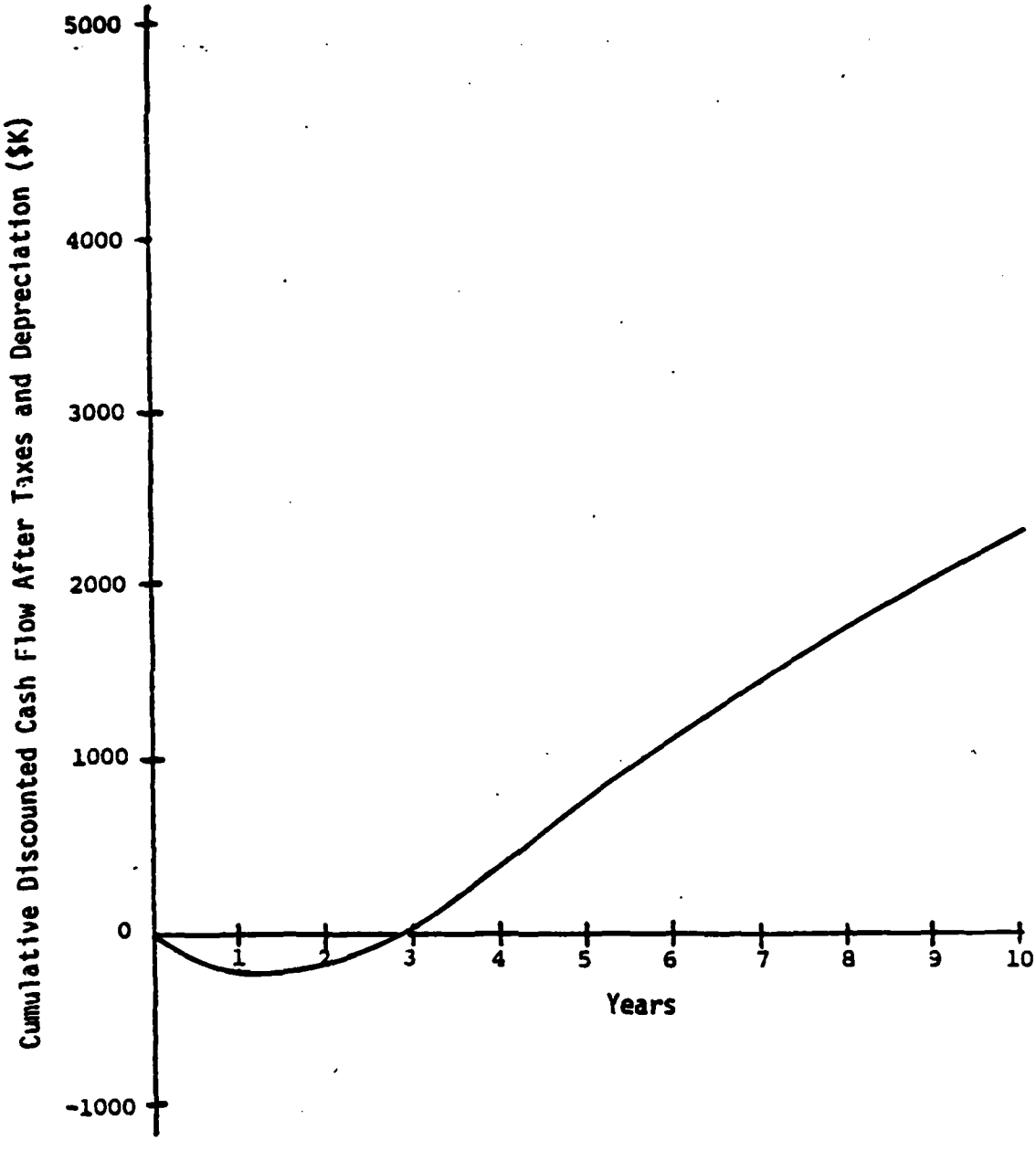
BCP = 4.63 **YTP** = 3.0 **ROI** 104.7%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 7

Case No. 6 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 3

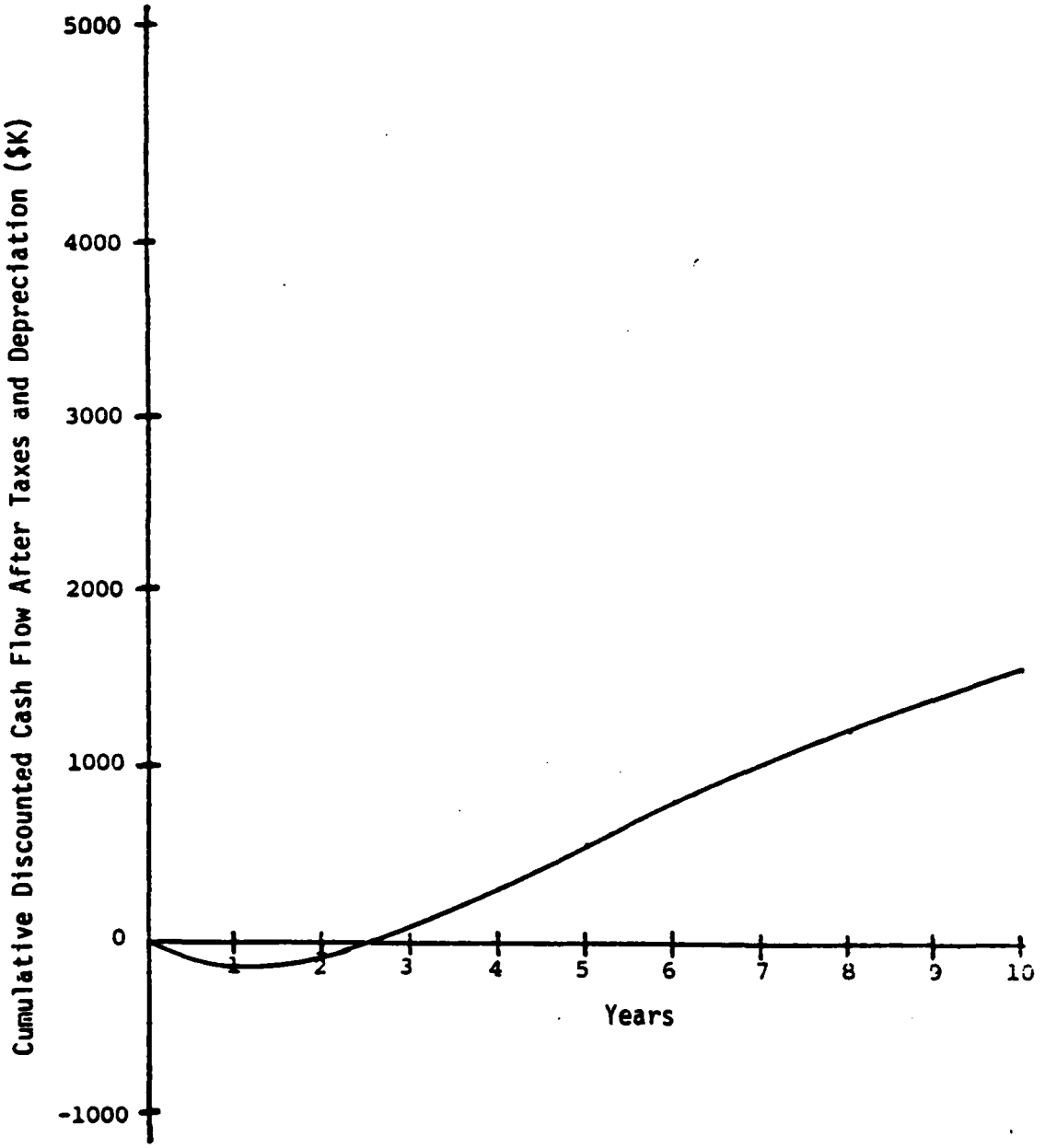
BCR = 4.88 YTP = 2.9 ROI = 102.5%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 6

Case No. 5 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 2

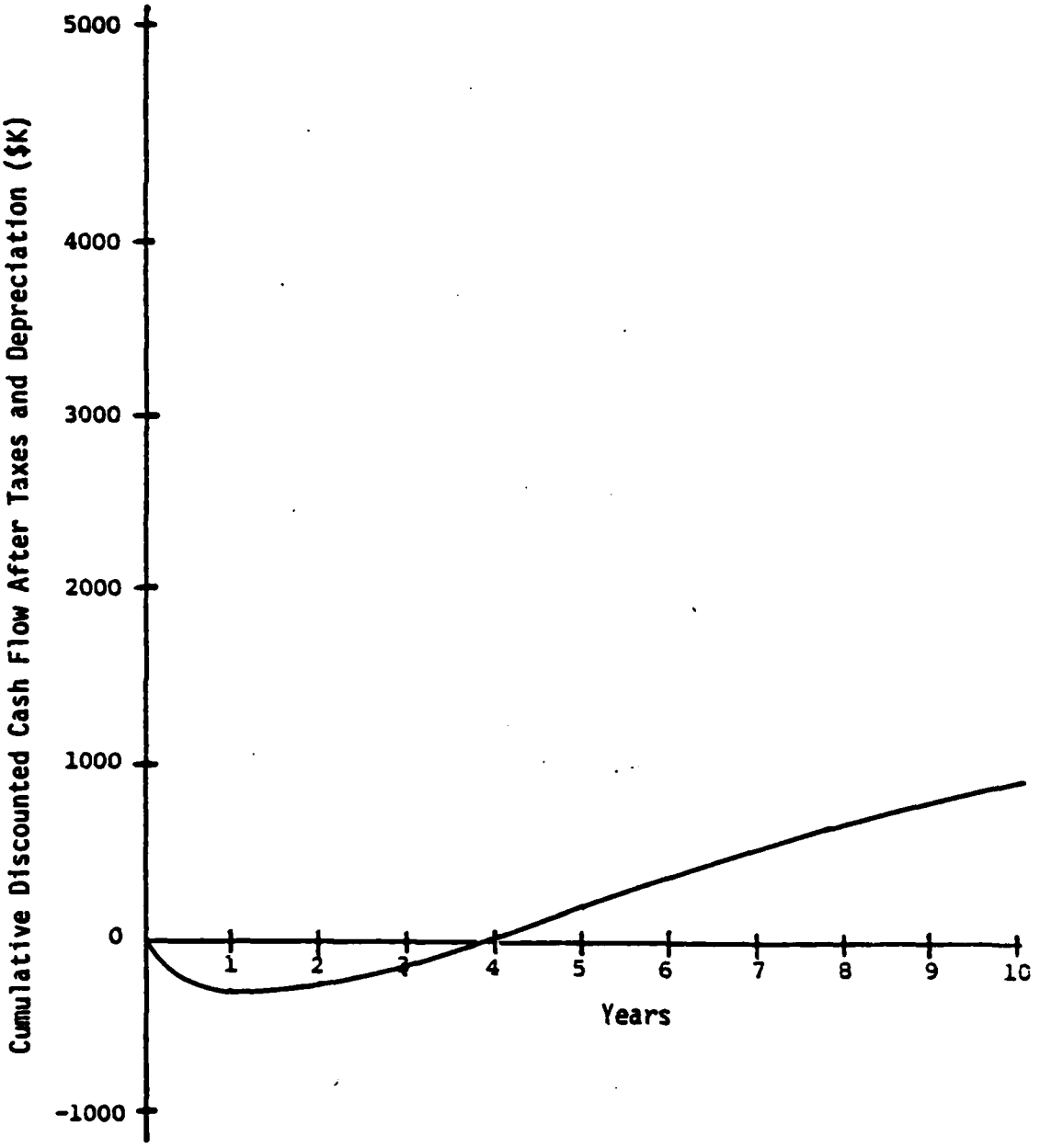
BCR = 6.72 **YTP** = 2.5 **ROI** = 120.1%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 5

Case No. 4 COMPOSITE DATA -- NON-CYLINDRICAL PARTS -- SYSTEM 1

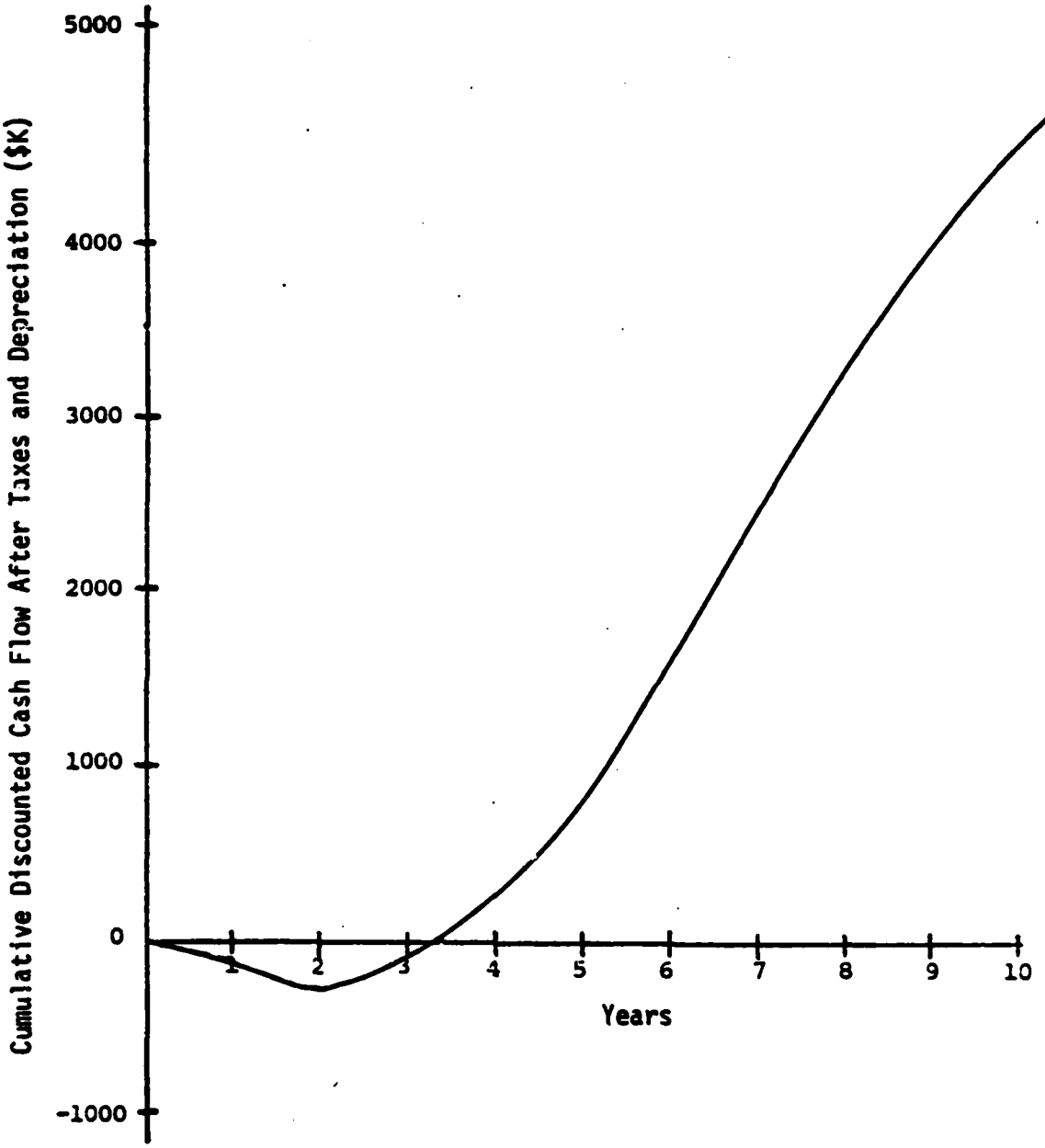
BCR = 3.04 YTP = 4.0 ROI = 51.7%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 4

Case No. 18 LARGE/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

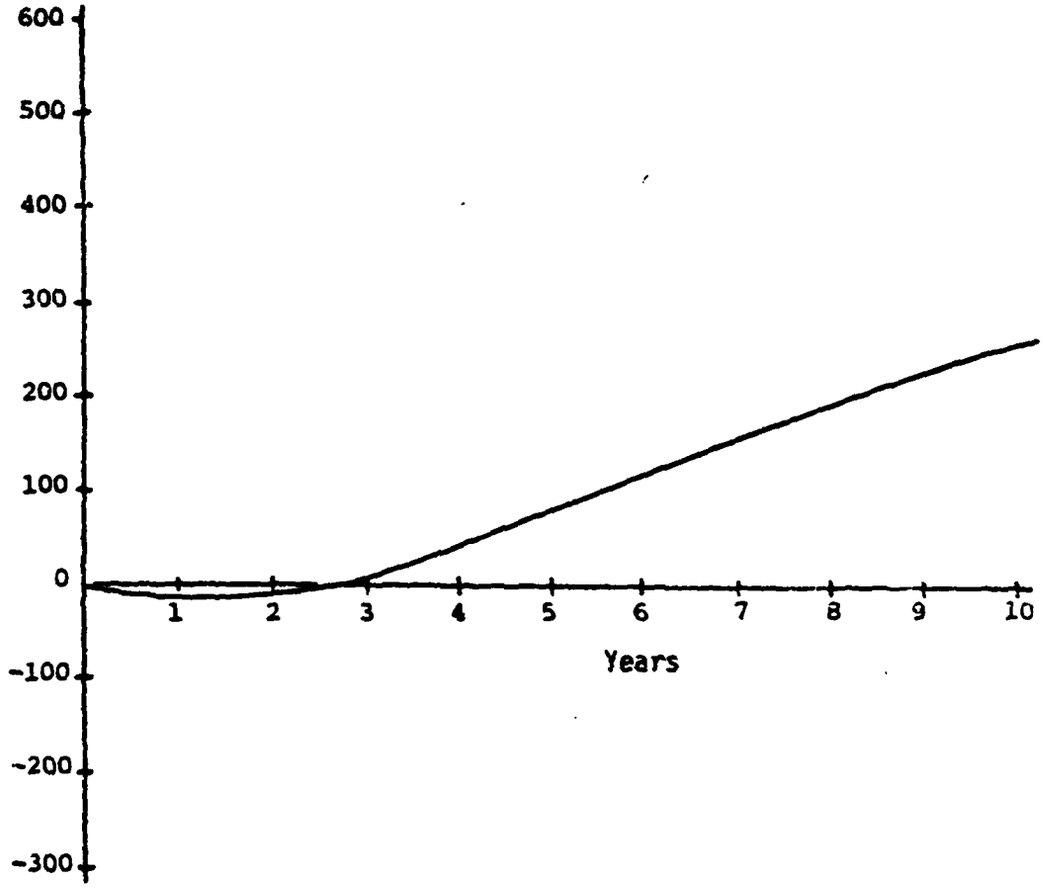
BCR = 5.83 YTP = 3.4 ROI = 109.6%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 18

Case No. 19 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 1

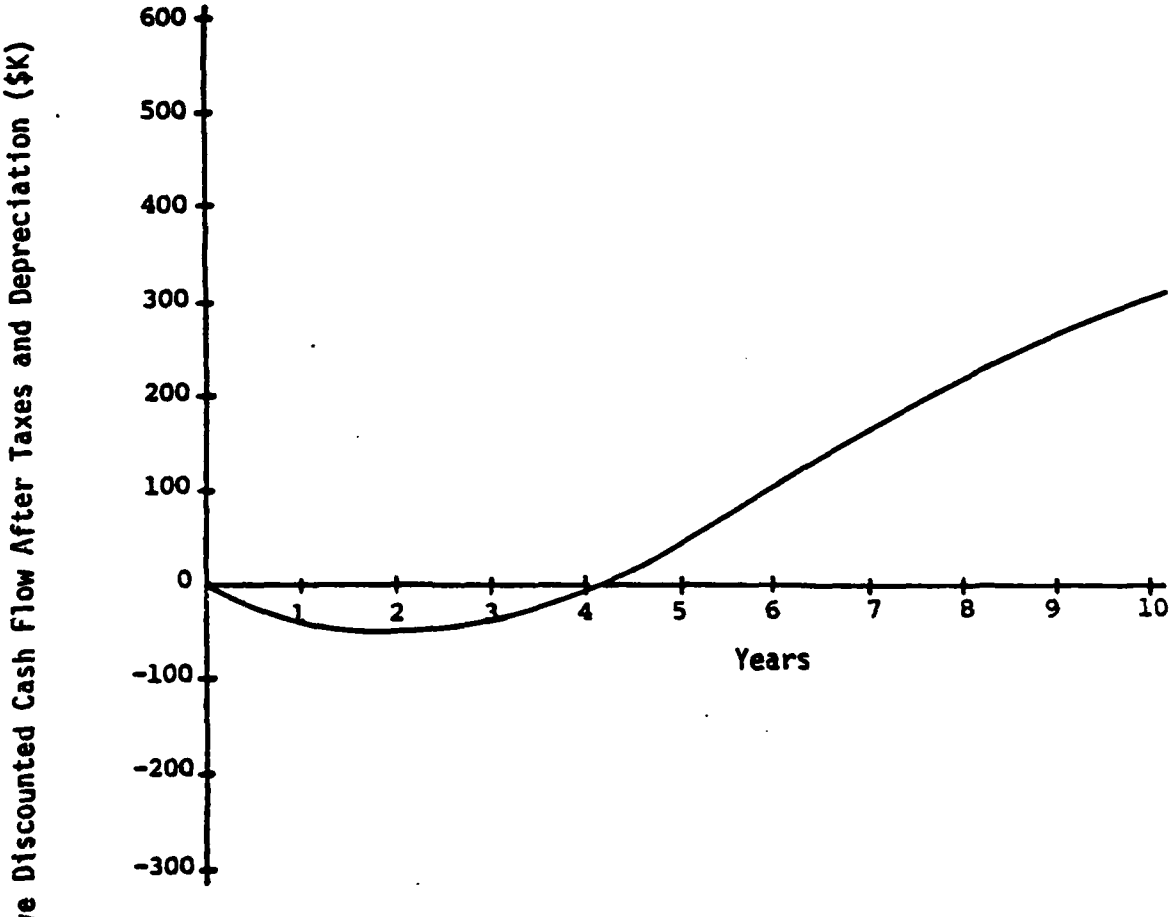
BCR = 7.53 YTP = 2.5 ROI = 134.9%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 19

Case No. 20 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 2

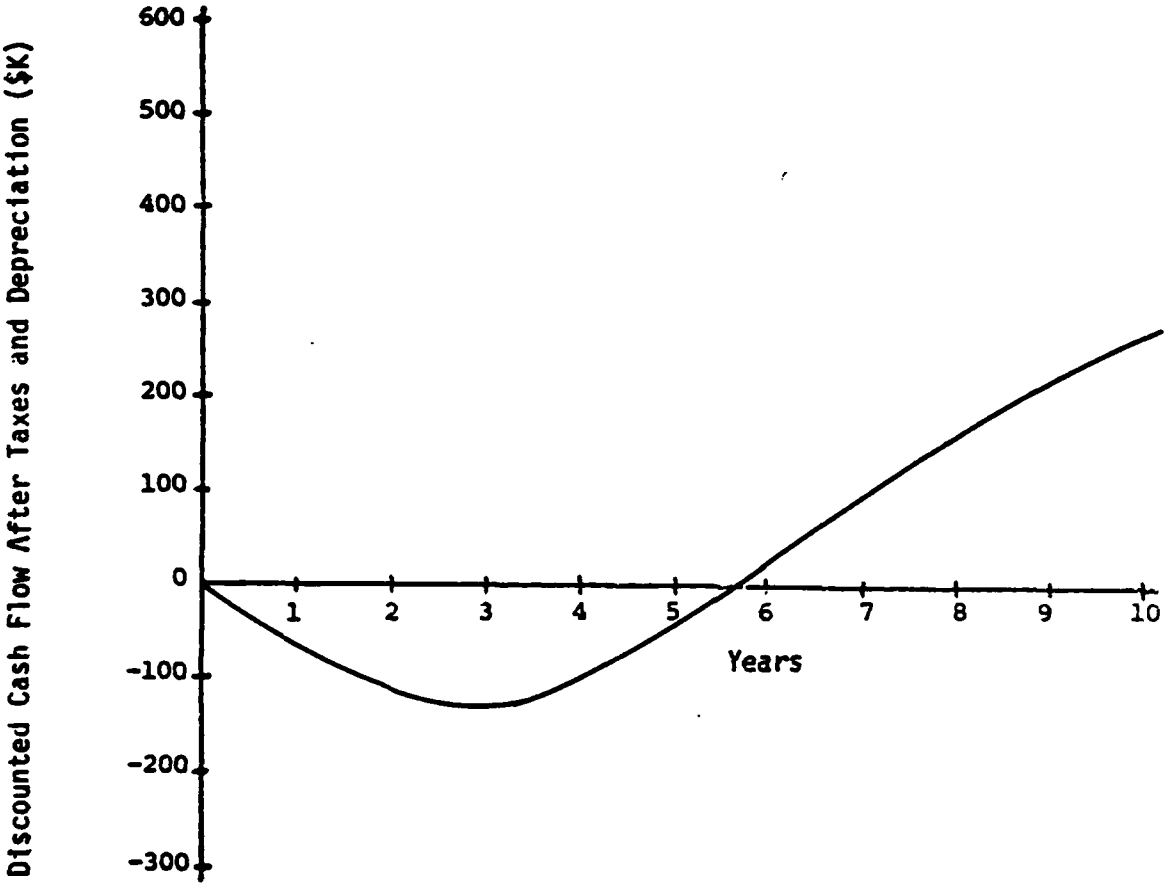
BCR = 3.43 **YTP** = 4.1 **ROI** = 61.%%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 20

Case No. 21 SMALL/HIGHLY SIMILAR PARTS -- CYLINDRICAL PARTS -- SYSTEM 3

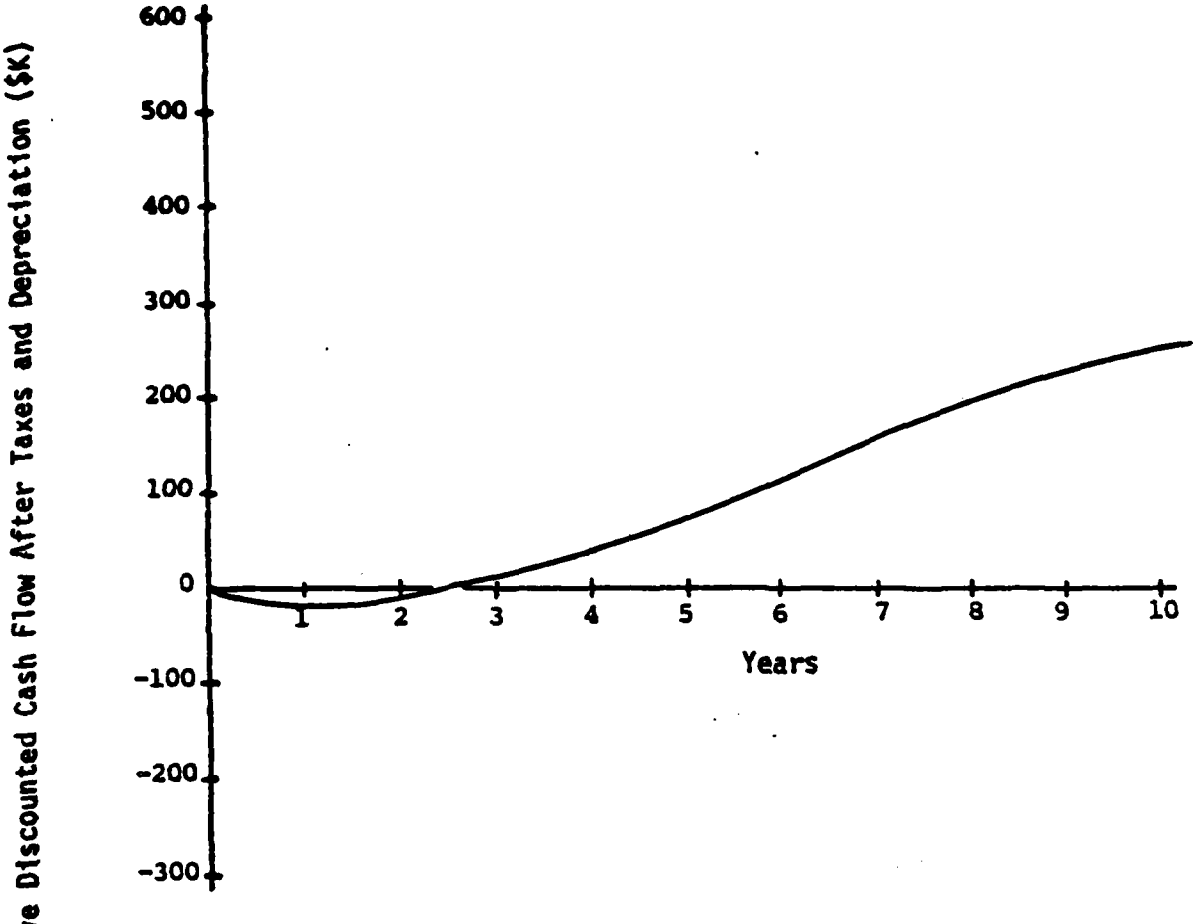
BCR = 1.91 **YTP** = 5.7 **ROI** = 38.2%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 21

Case No. 22 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 1

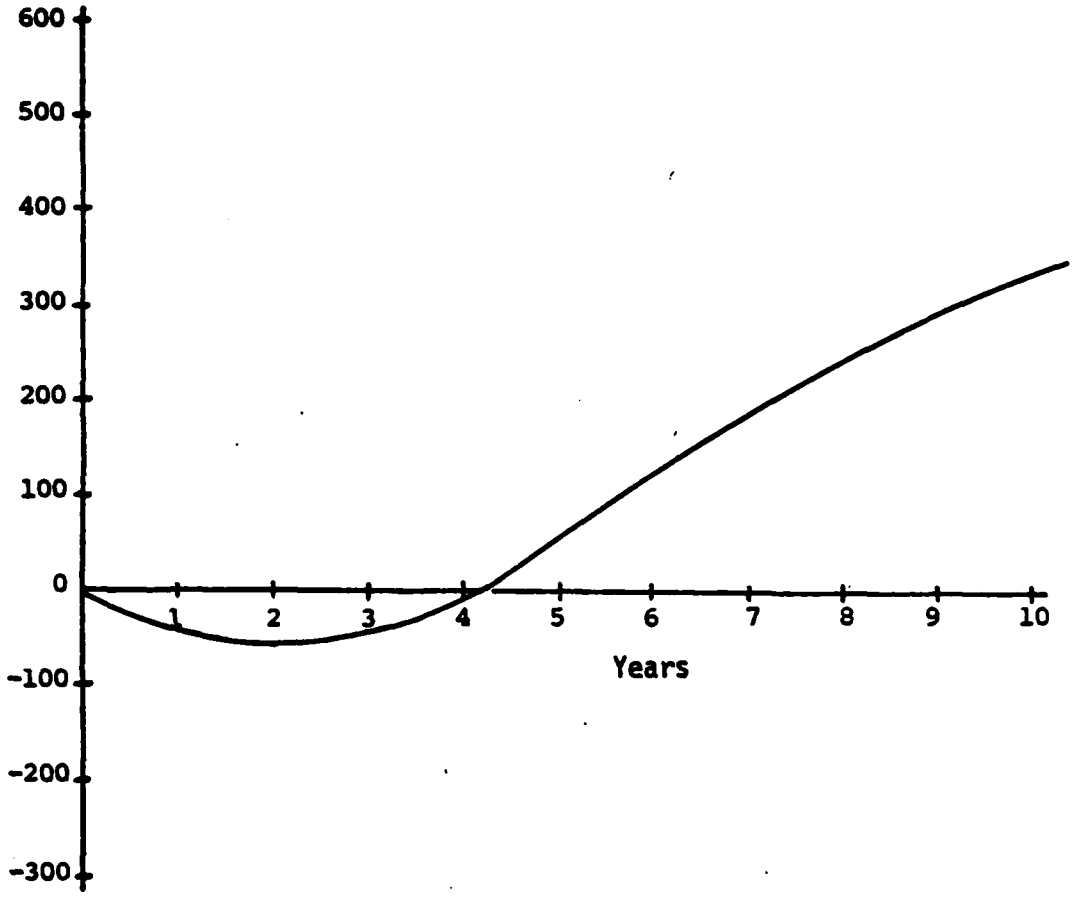
BCR = 7.48 **YTP** = 2.6 **ROI** = 124.4%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 22

Case No. 23 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 2

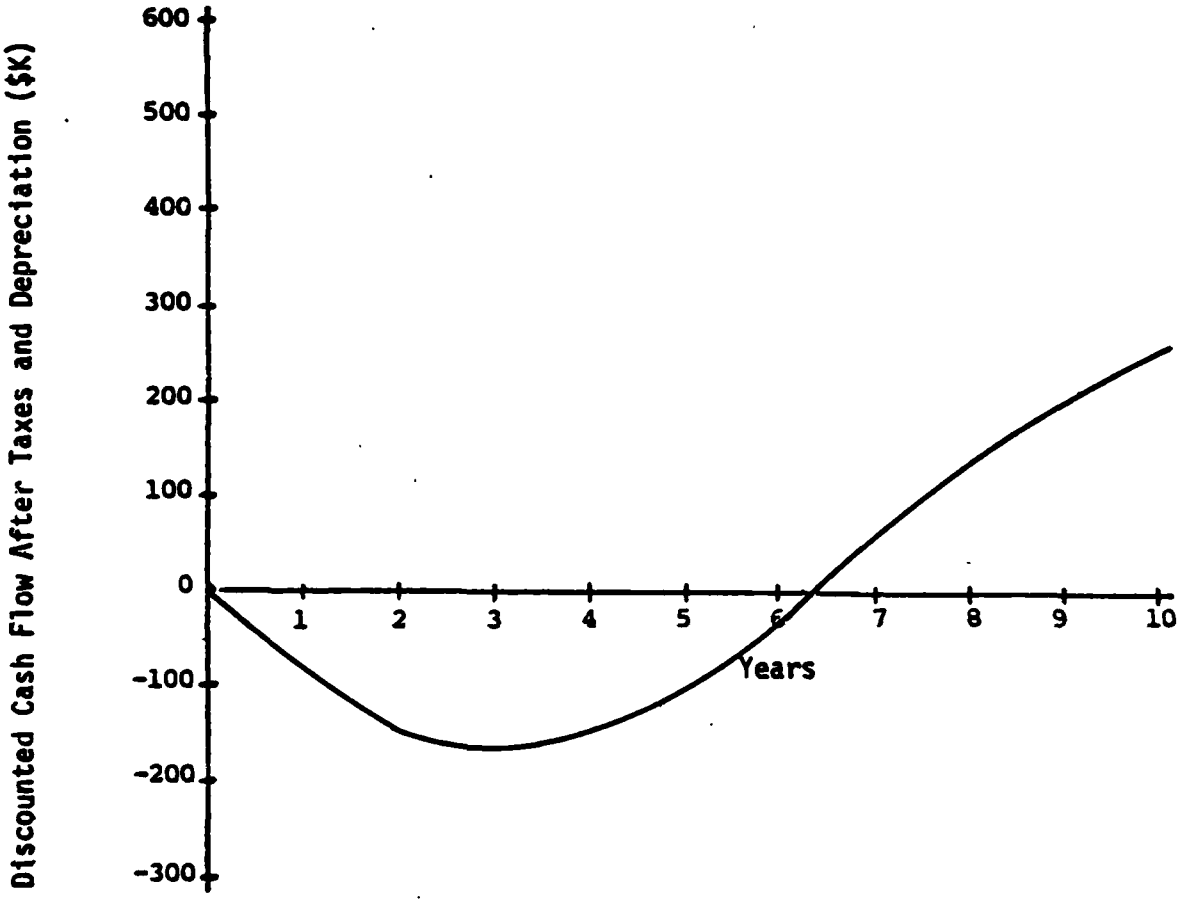
BCR = 3.41 YTP = 4.2 ROI = 59.4%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 23

Case No. 24 SMALL/HIGHLY SIMILAR PARTS -- NON-CYLINDRICAL PARTS -- SYSTEM 3

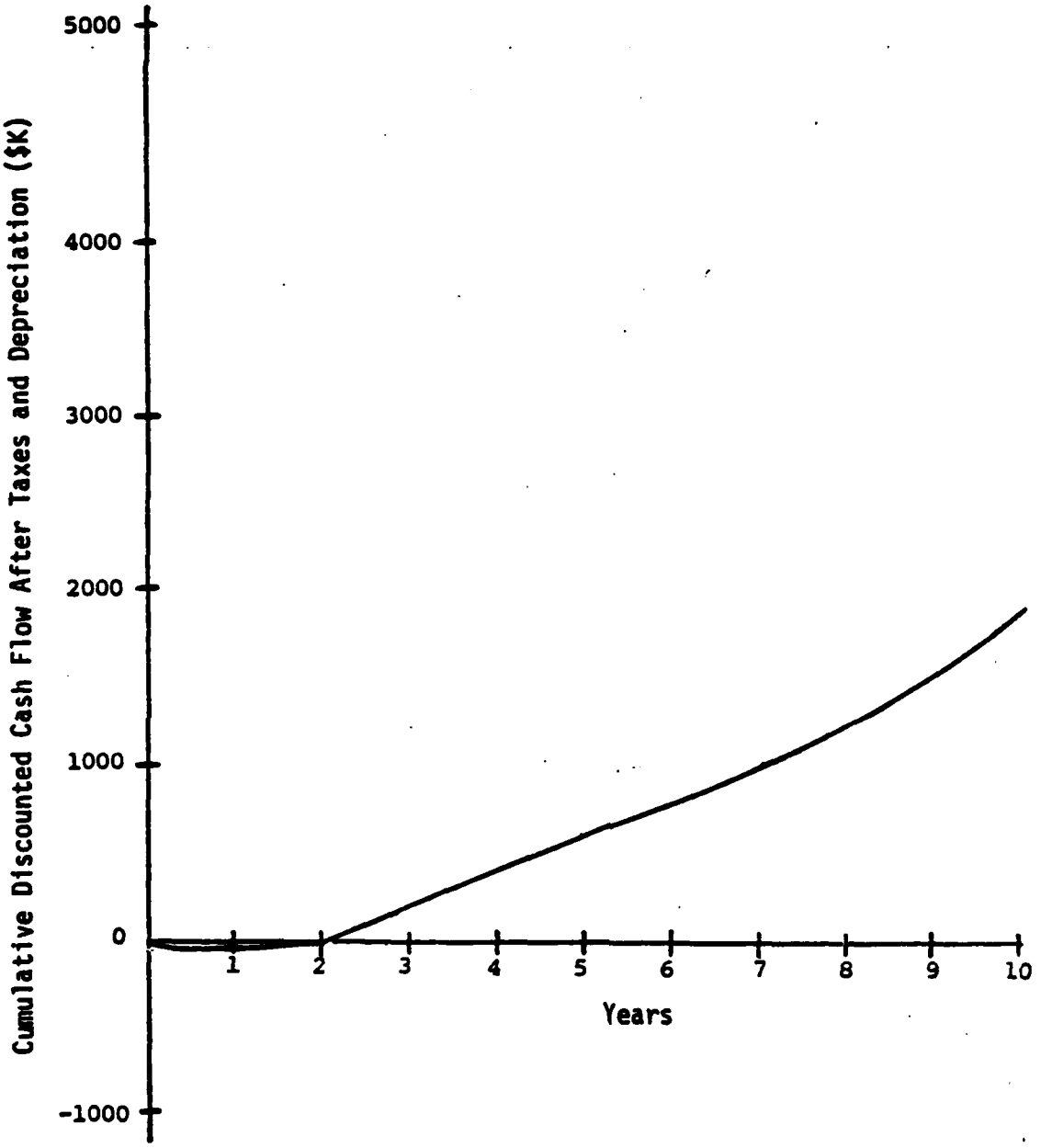
BCR = 1.70 **YTP** = 6.3 **ROI** = 29.9%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 24

Case No. 25 COMPOSITE (CASE 1 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

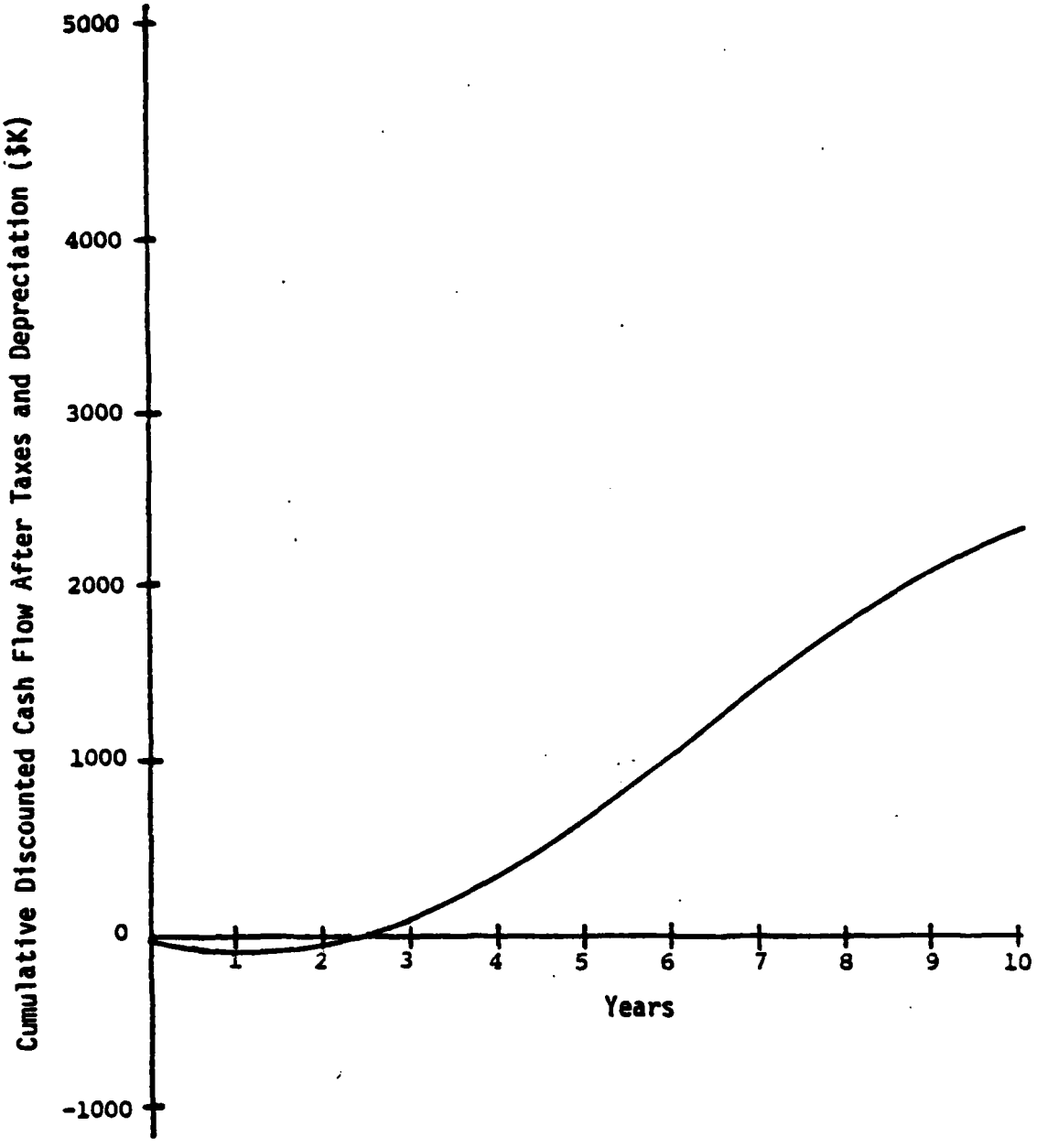
BCR = 11.12 YTP = 2.1 ROI = 197.7%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 25

Case No. 26 COMPOSITE (CASE 2 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

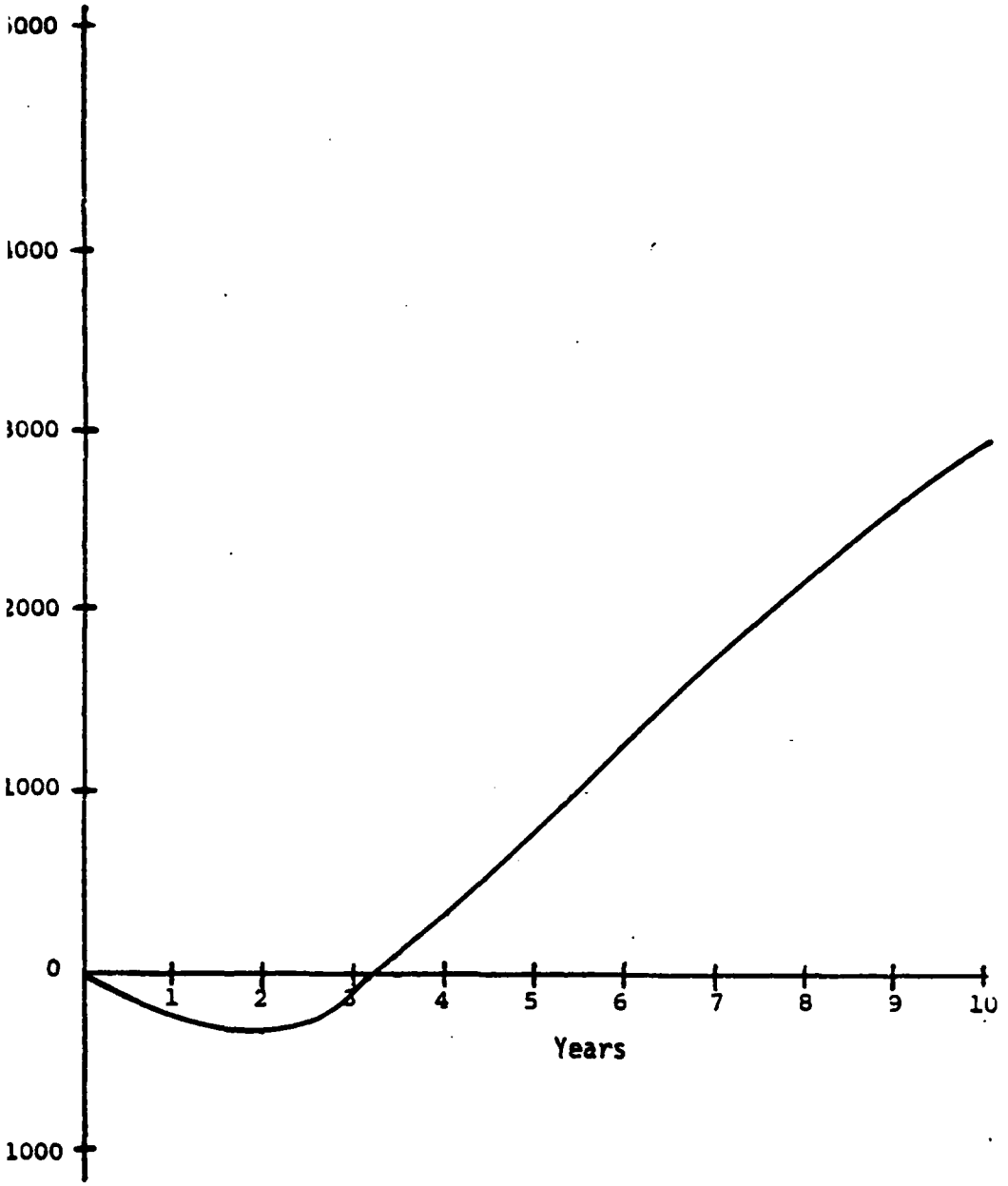
BCR = 8.06 **YTP** = 2.5 **ROI** = 123.9%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 26

ıse No. 27 COMPOSITE (CASE 3 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

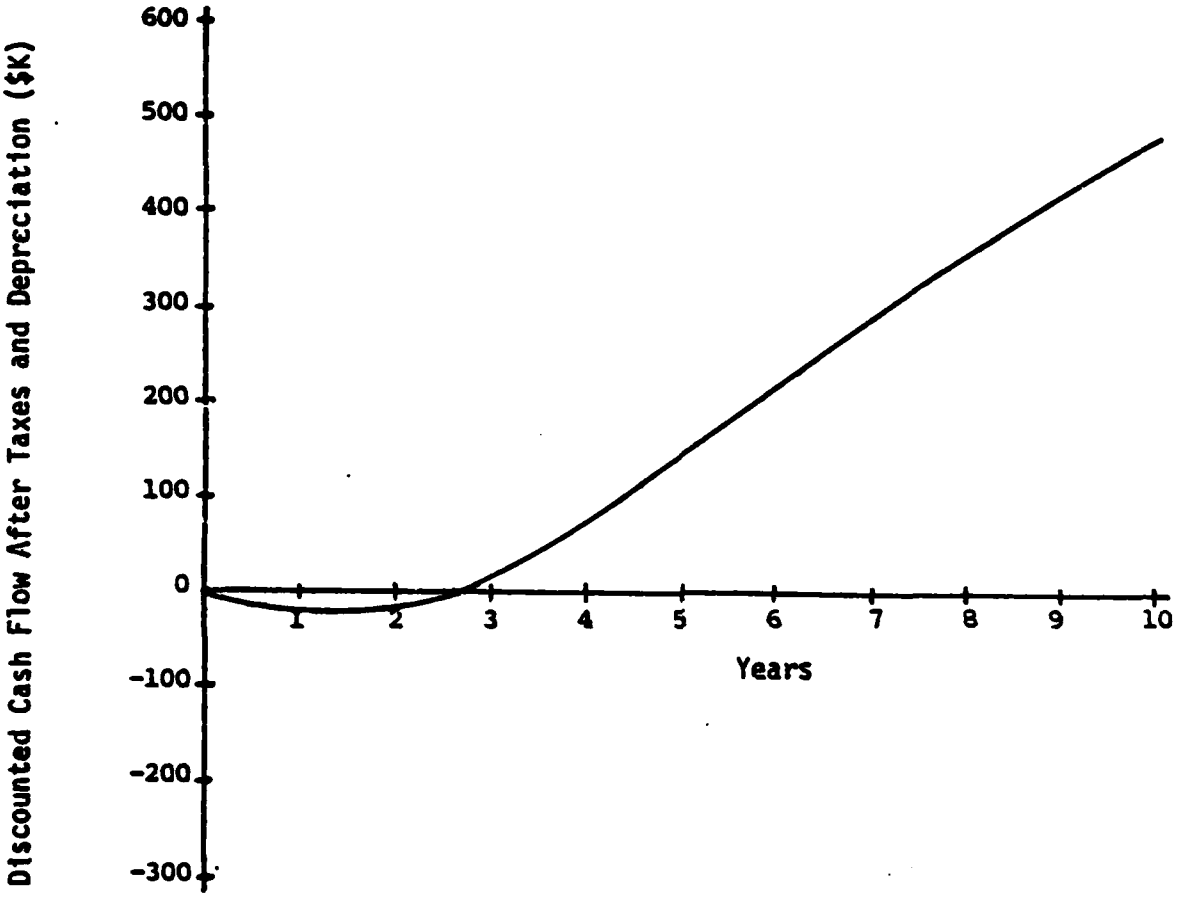
BCR = 5.57 YTP = 3.2 ROI = 88.9%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 27

Case No. 28 MED/SIM PARTS (CASE 7 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

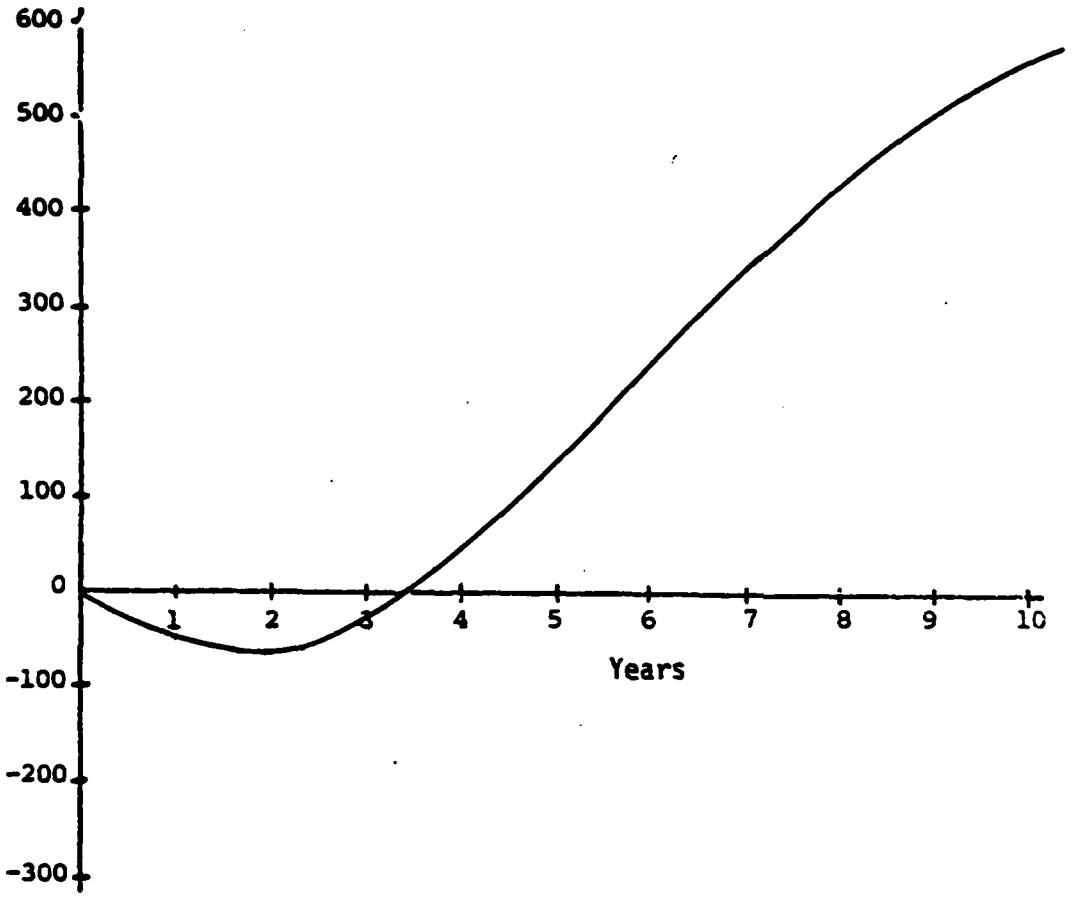
BCR = 5.43 **YTP** = 2.6 **RGI** = 125.5%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 28

ase No. 29 MED/SIM PARTS (CASE 8 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

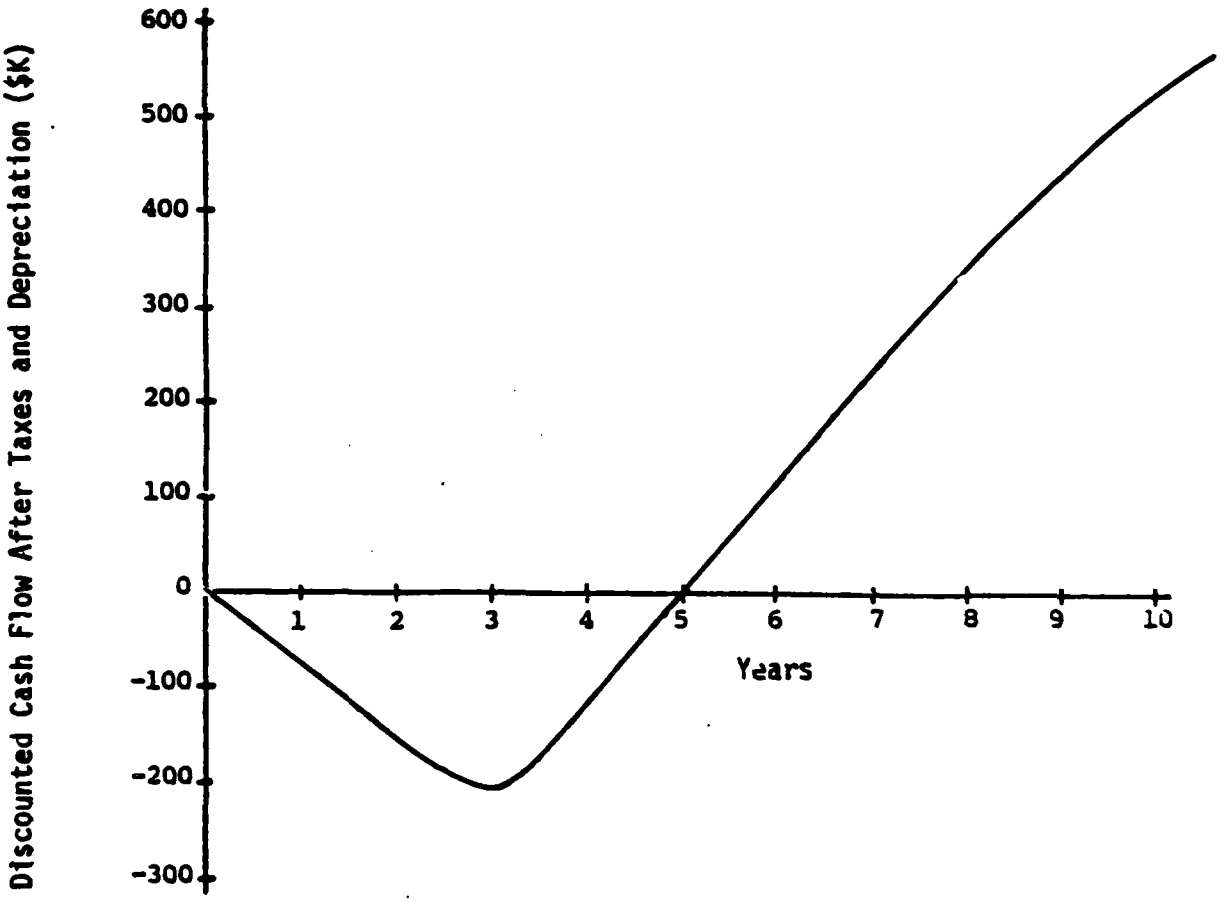
PCR = 2.82 YTP = 3.6 ROI = 77.6%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 29

Case No. 30 MED/SIM PARTS (CASE 9 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

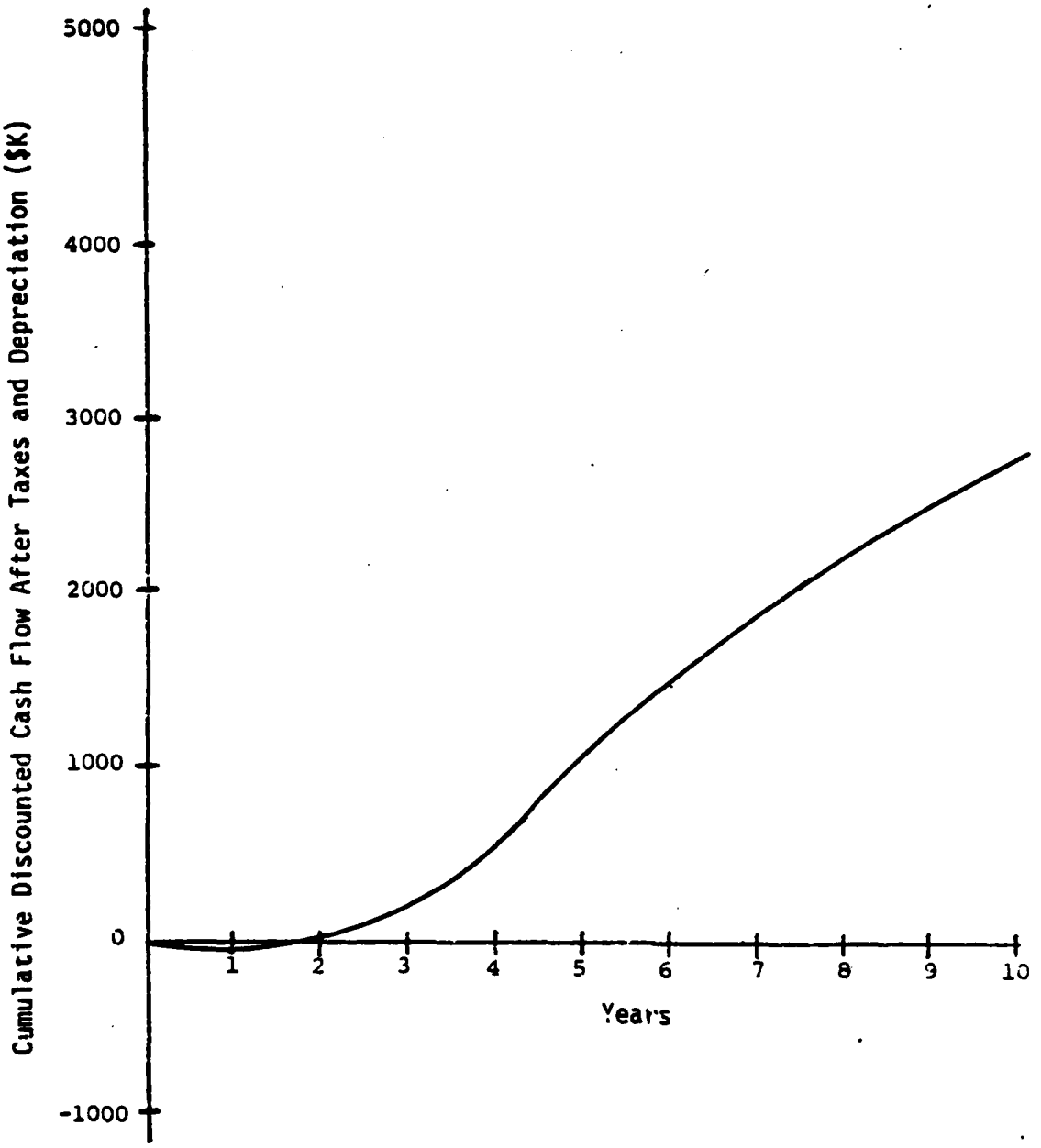
BCR = 1.92 **YTP** = 5.0 **ROI** = 46.2%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 30

Case No. 31 LG/HIGH SIM PARTS (CASE 13 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

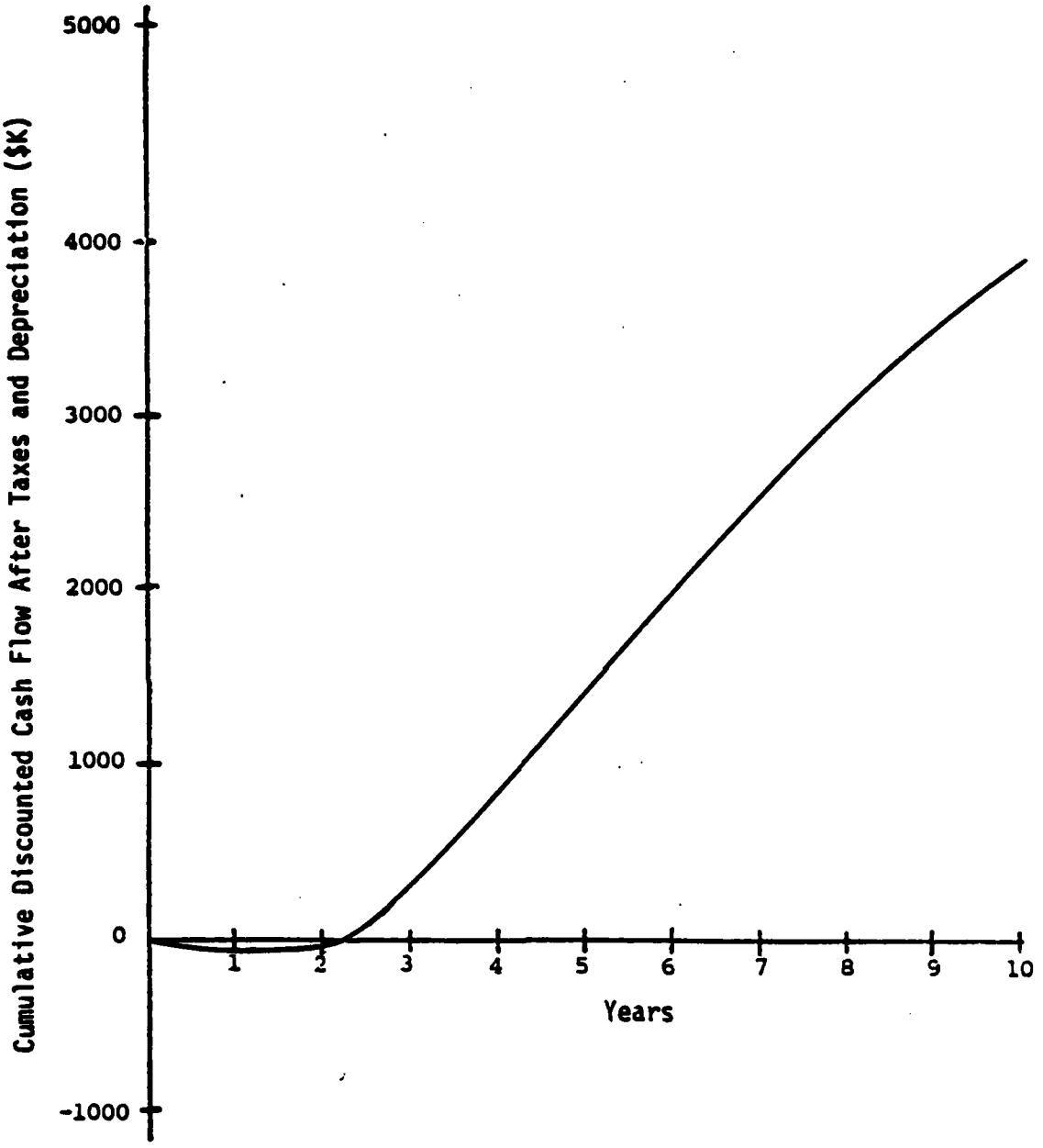
BCR = 15.49 YTP = 2.0 ROI = 317.4%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 31

Case No. 32 LG/HIGH SIM PARTS (CASE 14 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

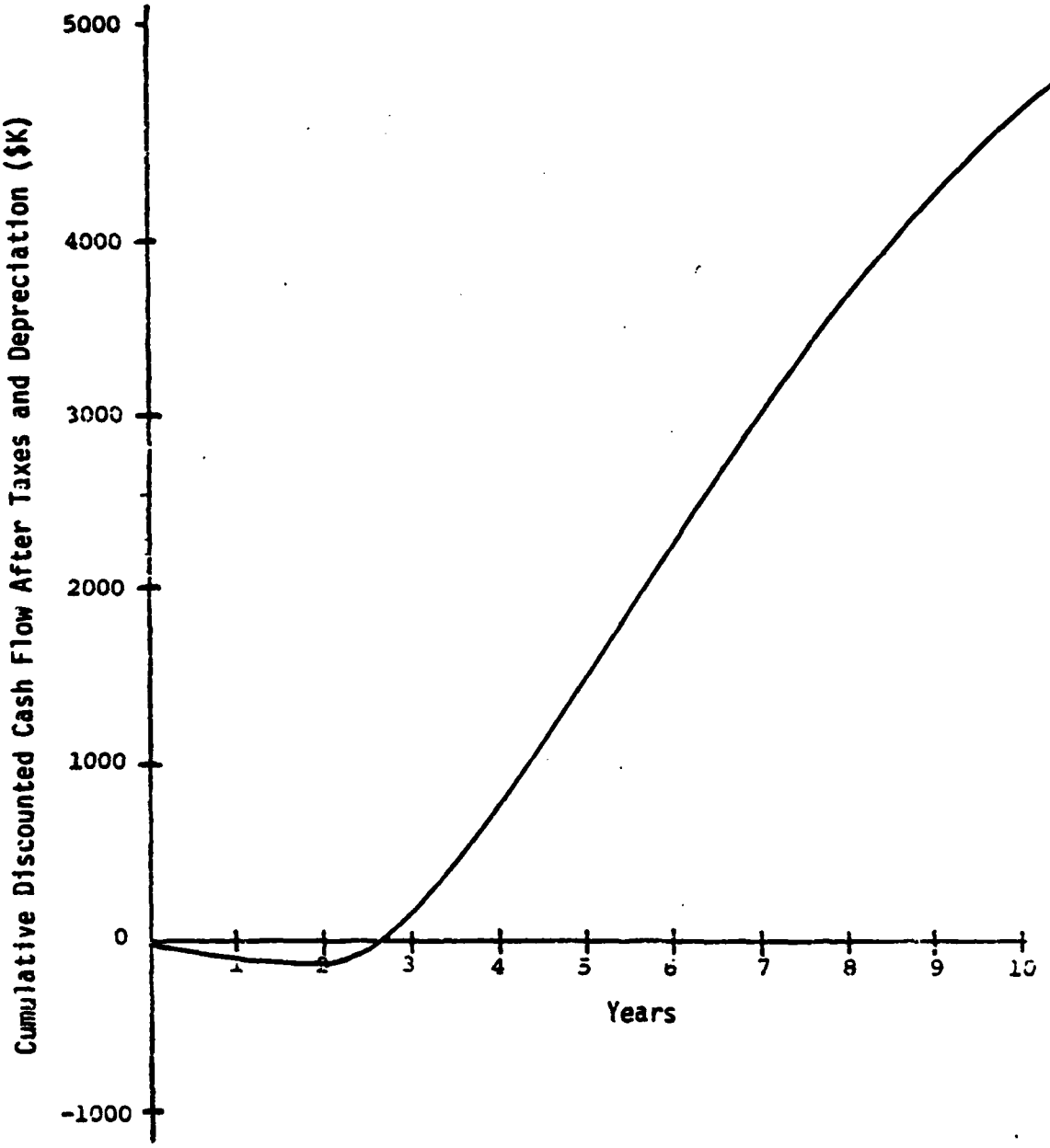
BCR = 9.73 **YTP** = 2.2 **ROI** = 242.8%



Plot of Cumulative Discounted Cash Flow Versus
Year for Case Number 32

Case No. 33 LG/HIGH SIM PARTS (CASE 15 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

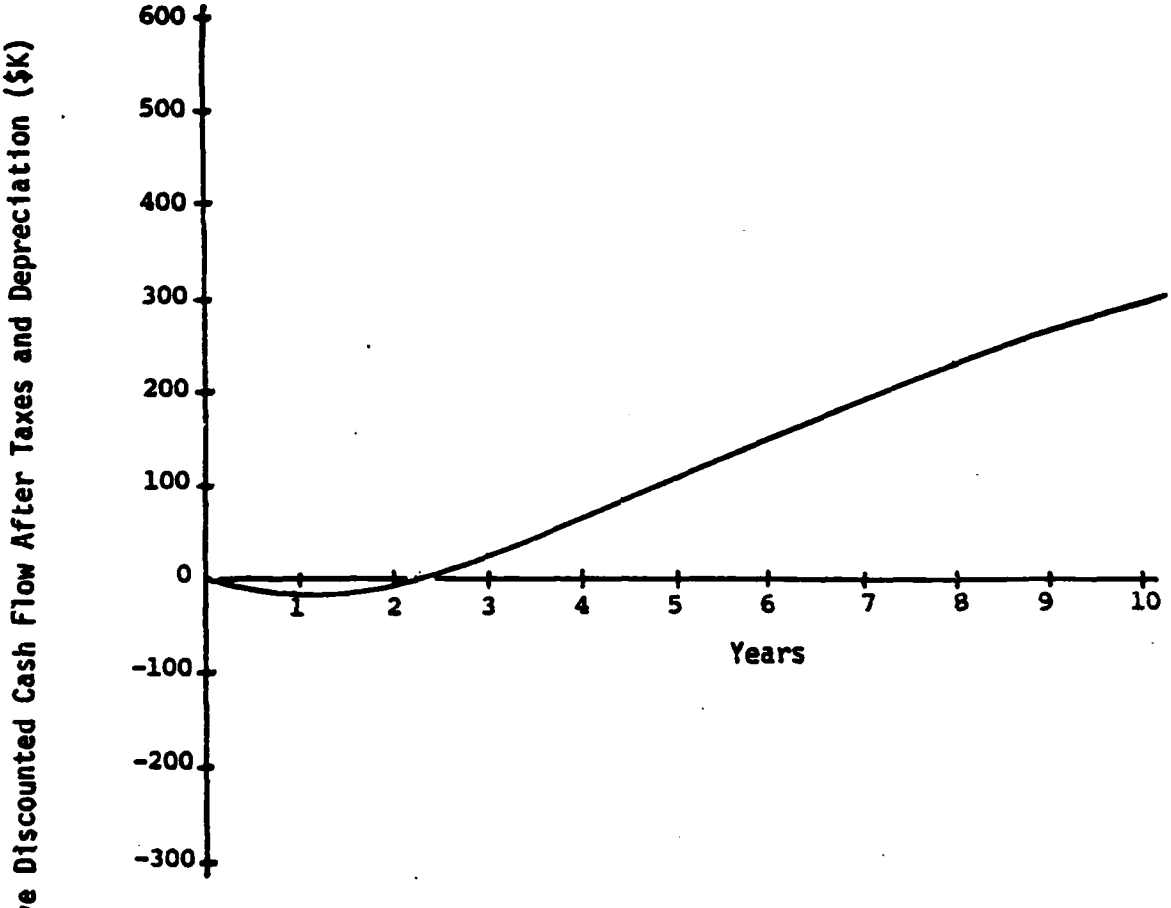
BCR = 6.70 **YTP** = 2.7 **ROI** = 171.7%



Plot of Cumulative Discounted Cash Flow Versus Year for Case Number 33

Case No. 34 SM/HIGH SIM PARTS (CASE 19 BUT W/UTRC PPI) -- CYL PARTS -- SYS 1

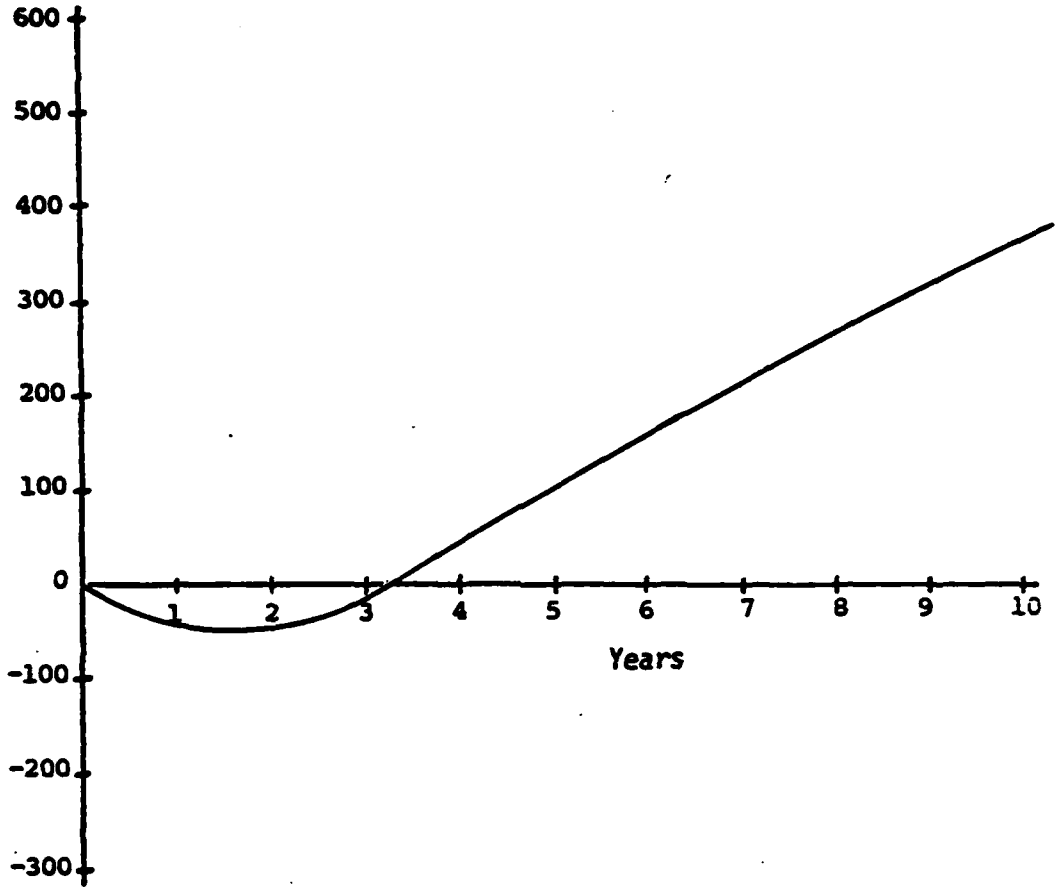
BCR = 8.66 YTP = 2.3 ROI = 168.0%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 34

Case No. 35 SM/HIGH SIM PARTS (CASE 29 BUT W/UTRC PPI) -- CYL PARTS -- SYS 2

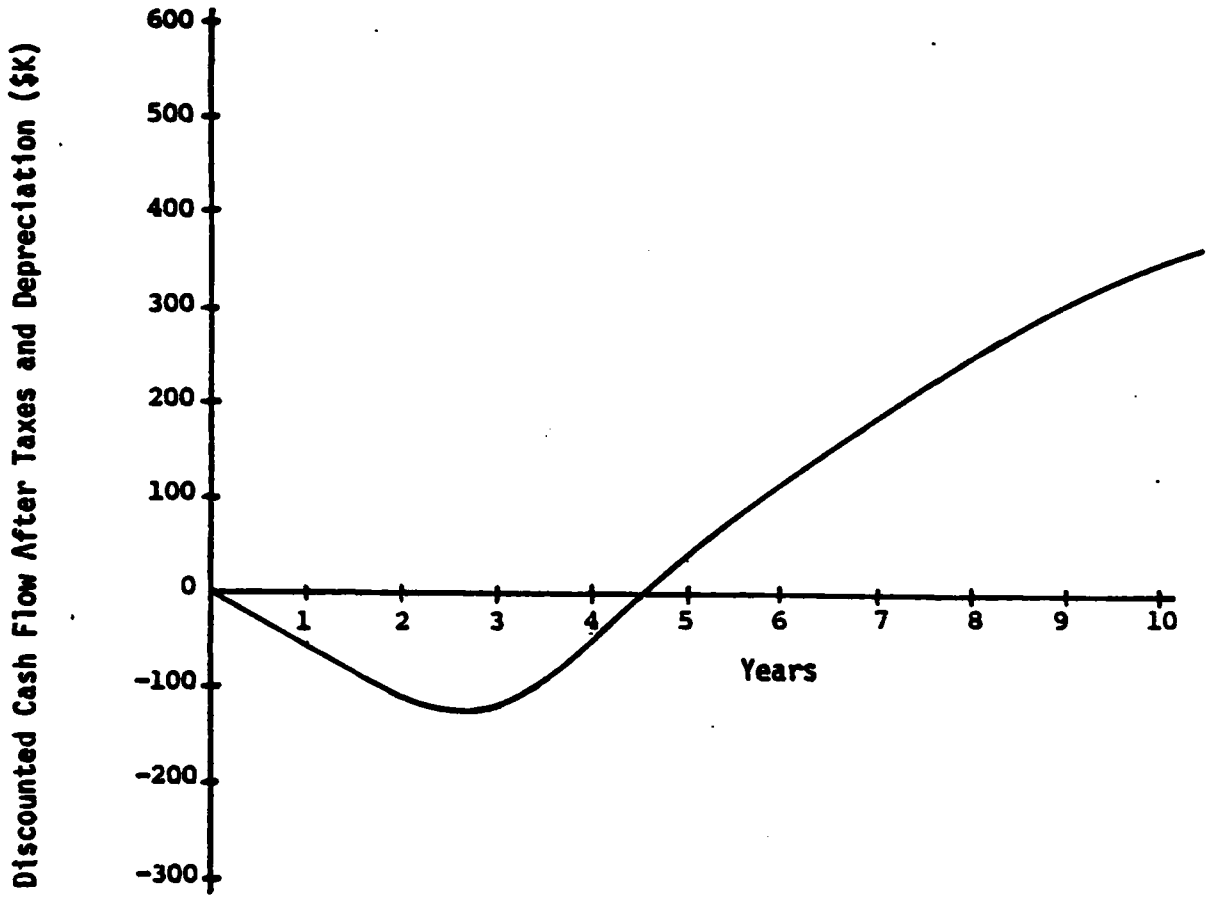
BCR = 3.93 **YTP** = 3.4 **ROI** = 76.6%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 35

Case No. 36 SM/HIGH SIM PARTS (CASE 21 BUT W/UTRC PPI) -- CYL PARTS -- SYS 3

BCR = 2.18 **YTP** = 4.5 **ROI** = 50.2%



Plot of Cummulative Discounted Cash Flow Versus Year
for Case Number 36

DISTRIBUTION LIST

Interim Report, Contract DAAH01-76-C-1104

Commanding General
U.S. Army Missile Command
Redstone Arsenal, Alabama 35809
ATTN: DRSMI-RLS/R. Kotler (16 copies)

Commanding General
U.S. Army Missile Command
Restone Arsenal, Alabama 35809
ATTN: DRSMI-IPBE/J. Scott (1 copy)

Naval Plant Representative Office
Pratt and Whitney Aircraft
East Hartford, Connecticut 06108 (1 copy)

END

FILMED

5-85

DTIC