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THESIS

A USER'S MANUAL FOR THE COST EFFECTIVENESS ANALYSIS MODEL (CEAMOD) VERSION 3.0

by

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This thesis develops a comprehensive procedures manual for Version 3.0 of the Cost Effectiveness Analysis (CEA) Model. The CEA Model is used in each service's Component Improvement Program (CIP) as a means of doing cost effectiveness analysis on Engineering Change Proposals (ECPs) for aircraft engines. The model uses expected values to calculate changes in life cycle costs that result from implementation of the ECP. A detailed analysis of the spreadsheet's calculations is provided to explain to users the model's logic. This comprehensive manual covers the model's history, assumptions, limitations, and format. Each worksheet of the model is described in detail including its purpose, explanations of each column, associated cell formulas and the logic behind them. The appendix provides a sample of each page of the CEA Model printout.

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A USER'S MANUAL FOR THE COST EFFECTIVENESS ANALYSIS MODEL (CEAMOD) VERSION 3.0

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ABSTRACT

This thesis develops a comprehensive procedures manual for Version 3.0 of the Cost Effectiveness Analysis (CEA) Model. The CEA Model is used in each service's Component Improvement Program (CIP) as a means of doing cost effectiveness analysis on Engineering Change Proposals (ECPs) for aircraft engines. The model uses expected values to calculate changes in life cycle costs that result from implementation of the ECP. A detailed analysis of the spreadsheet's calculations is provided to explain to users the model's logic. This comprehensive manual covers the model's history, assumptions, limitations and format. Each worksheet of the model is described in detail including its purpose, explanations of each column, associated cell formulas and the logic behind them. The appendix provides a sample of each page of the CEA Model printout.

TABLE OF CONTENTS

I. INTRODUCTION

This thesis develops a comprehensive procedures manual for Version 3.0 of the Cost Effectiveness Analysis Model (CEAMOD) implemented through a Microsoft EXCEL 5.0 spreadsheet. The model uses expected values to calculate changes in life cycle cost that result from a proposed engineering change to a component of an aircraft engine. A detailed analysis of the model's calculations is provided to explain to users the model's logic.

A. BACKGROUND

The CEA Model is used in each service's Component Improvement Program (CIP) as a means of doing cost effectiveness analysis on Engineering Change Proposals (ECPs) for aircraft engines.

NAVAIR Instruction 5200.35, *Policy, Guidelines and Responsibilities for the Administration of the Aircraft Component Improvement Program* states one of the objectives of the Navy's CIP is to maintain an engine design which allows the maximum aircraft availability at the lowest total cost to the government.

Typically, the investment cost in an ECP designed to improve aircraft availability is quite high. Economic justification for the incorporation of an ECP must show lower operational and support costs over the life of the engine to prove its cost effectiveness. Using CEA Model analysis, users are able to project out the effects of an ECP implementation on an engine's life cycle cost. The difference between the engine's life cycle cost in its current configuration and its life cycle cost with the implementation of the ECP are calculated. This evaluation facilitates a total cost comparison.

B. OBJECTIVES

In developing a comprehensive procedures manual for the CEA Model Version 3.0, the objectives of this thesis are:

1. To determine the concepts and logic behind the Cost Effectiveness Analysis Spreadsheet Model Version 3.0.

2. To determine the cell formulas used in the model.

3. To determine the variables used in the cell formulas and to explain what they represent.

This thesis continues the evaluation of the CEA Model begun by Davis (1991), Crowder (1992) and Clague (1992) and updates Reeves's (1993) User's Manual written for Version 2.0 of the model.

C. ORGANIZATION OF THE THESIS

This User's Manual uses the terms "page" and "sheet". The CEA Model Version 3.0 User's Guide describes the model in terms of pages. The rationale behind this choice of terminology is derived from the organization of the CEA Model Version 2.0. Version 2.0 had nine pages which grouped the calculations of the model into functional areas, all contained on one worksheet. These individual pages made up the printed output of the CEA Model.

CEA Model Version 3.0 separates most of these pages onto individual worksheets, the exception being that pages 3a, 3b, 4a and 4b are joined onto one worksheet to minimize calculation time. Therefore, this User's Manual is organized by the model's worksheets to maintain functionality. The pages contained in the worksheets still make up the printed output of the CEA Model, but the worksheets may include additional columns, cell equations and/or calculations not included on the printed output.

Chapter II describes the background of the Pratt & Whitney CEA Model, changes, assumptions, limitations and format of the model.

Chapter III describes the Input sheet, its input parameters and calculations.

Chapter IV describes the Standard History sheet including its formulas, variables and calculations.

Chapter V describes the page "3a 3b 4a 4b" sheet including its formulas, variables and calculations.

Chapter VI describes the page 5 sheet including its formulas, variables and calculations.

Chapter VII describes the Interim Calculations sheet, including its formulas, variables and calculations.

Chapter VIII describes the Summary sheet and Payback Chart sheet including their formulas, variables and calculations.

Chapter IX contains a summary of the thesis, conclusions and recommendations.

The appendix provides a sample printout of each page of the model.

II. THE PRATT & WHITNEY CEA MODEL

A. BACKGROUND OF THE MODEL

The Pratt & Whitney (P&W) CEA Model was originally used by the Air Force System Command's Aeronautical Systems Division as a means of evaluating engineering change proposals generated in the Component Improvement Program process. The model ran on an IBM mainframe computer using FORTRAN and a DYNAPLAN spreadsheet.

In an effort to standardize cost analyses between the two engine contractors working for the Air Force, the P&W engineering department agreed to provide General Electric (GE) a copy of the spreadsheet. GE adapted the model to a personal computer format using LOTUS 123.

In 1993 P&W decided to migrate from their mainframe based CEA spreadsheet to a personal computer based model. At this point, both engine manufacturers used personal computer spreadsheet-formatted CEA models which had differences. With the help of the CEA User's Group, the CEA model was standardized. In 1993, the Joint Propulsion Coordinating Committee (JPCC), which involves upper management for propulsion systems from the Army, Navy, and Air Force, accepted Version 2.0 of the P&W model as the initial standardized CEA spreadsheet. The CEA Model Version 2.0 converted the model to an EXCEL spreadsheet format.

B. CHANGES IN VERSION 3.0

CEA Model Version 3.0 incorporates a number of changes that enhance the operation and results of the analysis. These changes include:

1. Pages are on separate worksheets, except pages 3a, 3b, 4a, and 4b. The columns which calculate the number of field upgrades to perform (the "blue" equations) have been moved to the right of pages 3a, 3b, 4a and 4b.

2. The core logic has been changed to eliminate integerization of events.

3. The CEADECK.INI file has been moved to the Windows directory.

4. When closing the CEA Deck, EXCEL no longer asks if the CEADECK1 file should be saved.

5. A Microsoft style dialog box is now used to prompt users when switching standard fleet files.

6. The analysis has been extended from 33 to 45 calendar years.

7. A payback plot was added to the CEA Model workbook.

8. Macro files have been incorporated into the workbook and the print macro now uses Visual Basic which forces the model to recalculate prior to printing.

C. ASSUMPTIONS AND LIMITATIONS

The CEA Model takes into account only costs that occur after the engineering change proposal is developed. The investment costs that go into generating the engineering change proposal are not considered. Reeves (1993, p. 5) indicates this is a reasonable approach considering engineering change proposal developmental costs are funded by RDT&E appropriations while the expected operating savings would come from Operations and Maintenance (O & M) appropriations. Crowder (1992, p. 41) argues that until the Concept & Definition and Acquisition phases are included in the model, an accurate trade off analysis between these costs and "useful life" costs can not be made.

Since the CEA Model is capable of handling only one failure rate, it is therefore limited to modeling one component change at a time. This leaves the model incapable of doing more complex analysis.

The failure rates used in the model are based on a Poisson distribution. A Poisson distribution uses a constant failure rate. Clague (1992, p. 6) points out that this inflexibility inhibits the user from modeling the engine failure rate to consider an increasing rate during phase in and a decrease rate during phase out.

The accuracy of the model's results are dependent on the accuracy of the user's inputs. Crowder (1992, p. 22) identified Incorporation Style, Kit Hardware Cost, and Spare Part Factor as the principal cost drivers in his analysis of an earlier version of the CEA Model. Crowder also points out the sensitivity of the model to changes in reliability (1992, p. 35). The implications of these findings are that inaccurate estimates for the model's input parameters can cause significant differences in the results of the analysis.

D. FORMAT OF THE MODEL

The model is implemented through an EXCEL 5.0 workbook. It consists of seven worksheets each identified by a standard EXCEL worksheet tab. Each page of the model has its own worksheet, except pages 3a, 3b, 4a, 4b which have been retained on a single worksheet to minimize calculation time. The printed output consists of all ten pages of the model or any combination of the ten pages chosen by the user. The worksheet associated with the respective page may contain columns, cells and/or calculations not included on the printed page.

The pages of the model are: Input page, Page 1; Standard History, Page 2; Current Configuration, Pages 3a and 3b; Proposed Configuration, Pages 4a and 4b; Page 5; Interim Calculations page, Page 6; Summary page and Payback Chart.

Each page/sheet is made up of columns and rows which facilitate the organization of input data and calculations. The heart of the CEA calculations are implemented via formulas designated by column. The calculation is applied to each year of the analysis designated by row.

Calculations can be traced throughout the model by following cell addresses and/or variable names in each cell formula which make up the column calculations.

III. DESCRIPTION OF THE INPUT SHEET

A. INTRODUCTION

The Input sheet contains page 1 of the model and is identified by the worksheet tab labeled 'Input'. This worksheet displays the input parameters that drive the CEA Model. The values are either calculated by their associated cell formula or directly entered by the user. The worksheet is broken into five sections: Task Incorporation Input, Scheduled Input, Unscheduled Input, Standard Inputs, and Optional Input. This chapter describes each section in detail.

The input cells are named to make their identification easier when used as variables in other cell formulas in the spreadsheet. The names are displayed in the EXCEL Namebox which appears at the left end of the formula bar.

B. DESCRIPTION OF TASK INCORPORATION INPUT PARAMETERS LINE 1.0 THROUGH LINE 15.0

The Task Incorporation Input section is made up of fifteen input parameters listed by line number in column B of the worksheet and by task in column C of the worksheet. The input is made in column D, over the blue formatted values.

1. Line 1.0 Incorporation Style (IncorpStyle)

IncorpStyle is cell 'Input'!$D$9 and determines how the change is incorporated. The user is given three options:

1 = Attrition - Incorporates the change as failures occur in the engines. The parts are replaced as spares and no useable hardware is scrapped, or

2 = Retrofit at First Opportunity - Incorporates the change when scheduled or unscheduled maintenance provides access to the part, whichever occurs first, or

3 = Forced Retrofit - Incorporates the change via an independent maintenance event with an objective of implementing the change. The rate, in kits per month, the change is incorporated into the engine is entered in cell 'Input'$D$12 and is labeled ForcedRetroRate.

According to Crowder, (1992, p. 23) Retrofit at First Opportunity is used ninety-nine percent of the time because of its low cost and simplicity. His analysis also determined that the Attrition and Forced Retrofit options increased the life cycle cost of the engineering change proposal by 25 and 28 percent respectively. (pp. 23-24)

2. Line 2.0 Does Kit Cost Replace Normal Maintenance Material Cost? (KitCostReplaceNormalMaint)

KitCostReplaceNormalMaint is a switch that identifies if the kit cost is in addition to the normal maintenance material cost (0 = "No") or if it replaces it (1 = "Yes") and is entered into cell 'Input'!$D$14.

3. Line 3.0 Delta Production Cost (DeltaProdCost)

Delta Production Cost describes the difference in the price of the production engine due to the change. The amount is entered directly into cell 'Input'!$D$15.

4. Line 4.0 Kit Hardware Cost - $/Engine (KitCost)

KitCost represents the material cost of the kit. If the change does not use a kit, KitCost is the cost of the upgraded parts. The amount is entered into cell 'Input'!$D$16.

Crowder (1992, p. 24) identifies kit cost as a cost driver in his analysis. He advises the user to carefully consider this cost. Kit cost is represented by a linear function and at some cost the modification becomes uneconomical to incorporate.

5. Line 5.0 Kit Labor Manhours at O & I (KitLaborOI)

KitLaborOI is cell 'Input'!$D$17 and represents the base level man-hours required to install the kit at the Organizational or Intermediate level (O & I).

6. Line 6.0 Kit Labor Manhours at Depot (KitLaborDepot)

KitLaborDepot is entered into cell 'Input'!$D$18 and represents the base level man-hours required to install the kit at the depot level.

Lines 5.0 and 6.0 use the same method to determine labor hours required. The contractor determines these values through logistics support analysis based on detailed historical records of service maintenance. (Davis, 1991, p. 27)

7. Line 7.0 Technical Pubs Cost - Total $ (TechPubsCost)

TechPubsCost is cell 'Input'!$D$19 and represents the total cost of the modification or creation of technical publications due to the change.

The TechPubsCost data is supplied by the contractor and is usually a minor cost based on a page count. (Davis, 1991, p. 27)

8. Line 8.0 TCTO/Technical Directives Cost - Total $ (TctoCost)

TctoCost is entered into cell 'Input'!$D$20 and represents the total cost, in dollars, to produce a Time Compliance Technical Order or Technical Directive if required by the change.

9. Line 9.0 Tooling/Support Equipment Cost - Total $ (ToolSE.Cost)

ToolSE.Cost is entered in cell 'Input'!$D$21 and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification.

The costs to modify current tooling and support equipment necessary to carry out the engineering change proposal are also included in this cost. (Davis, 1991, p. 28)

10. Line 10.0 Spare Parts Factor (SparePartFactor)

SparePartFactor represents the percentage, relative to the fleet size, that is used to generate kit costs for spare parts. The spares are not engine spares because they are usually modeled as part of the fleet. The spares could be component and/or assembly spares. The spare parts factor takes into account the current configuration inventory which needs to be upgraded or replaced to ensure pipeline spares availability.

SparePartFactor is entered in cell 'Input'!$D$22 and is determined by the contractor using an operations and support costs model. (Davis, 1991, p. 28)

11. Line 11.0 Scheduled % Events being Modified (SchPctEvtMod)

Cell 'Input'!$D$24, labeled SchPctEvtMod, represents the percentage of scheduled maintenance events during which modifications can be performed. One-hundred minus the input value represents the percentage of remaining scheduled events during which modifications will not occur.

The only restriction on this value is that it must be greater than or equal to the estimated percentage of units discarded due to the component being beyond economical repair (scheduled percentage scrapped units). This caveat prevents a unit which is beyond economical repair from being replaced by an unmodified component. (Reeves, 1993, p. 13)

12. Line 12.0 Unscheduled % Events being Modified (UnschPctEvtMod)

Cell 'Input'!$D$25, labeled UnschPctEvtMod, represents the percentage of unscheduled maintenance events during which modifications can be performed. One-hundred minus the input value represents the percentage of remaining unscheduled events during which modifications will not occur.

The only restriction on this value is that it must be greater than or equal to the estimated percentage of units discarded due to the component being beyond economical repair (unscheduled percentage scrapped units). This caveat prevents a unit which is beyond economical repair from being replaced by an unmodified component. (Reeves, 1993, p. 13)

13. Line 13.0 Unscheduled Event Rate allowing Modification (UnschEvtRateMod)

UnschEvtRateMod is entered into cell 'Input'!$D$26 and represents an estimate of the rate at which an unscheduled maintenance event will occur that will provide an opportunity to incorporate the change. This is not necessarily the failure rate for the part, assembly, component, or module being replaced or modified.

14. Line 14.0 Production Incorporation Date (ProdIncorpYr and ProdIncorpMo)

ProdIncorpYr and ProdIncorpMo represent the contractor's estimate of when the change will begin to be incorporated into engines in production. Cell 'Input'!$D$28 is the year and cell 'Input!$F$28 is the month the change will begin to be incorporated into production engines.

15. Line 15.0 Field Incorporation Date (FieldIncorpYr and FieldIncorpMo)

FieldIncorpYr and FieldIncorpMo represent the contractor's estimate of when the change will begin to be incorporated into engines already produced. Cell 'Input'!$D$29 is the year and cell 'Input!$F$29 is the month the change will begin to be incorporated into fielded engines.

The purpose of this input is to recognize the possibility that engines on the production line will receive the initial supply of modified components and that field modifications would be delayed until an adequate number of modified components were available. (Davis, 1991, p. 28-29)

C. DESCRIPTION OF SCHEDULED INPUT PARAMETERS LINE 16.0 THROUGH LINE 30.0

The fifteen input parameters in this section deal with scheduled events. The format consists of two columns, one representing the current engine configuration (column E) and the other representing the proposed engine configuration (column F). The percentages in this section refer to the percentage of all scheduled events for a given year.

1. Line 16.0 Scheduled Maintenance Interval (TAC or TOT or EFH) and (CurSchMaintInt and ProSchMaintInt)

Cell 'Input'!$E$32 allows the user to enter the amount of time allowed to accumulate on the current engine configuration before scheduled maintenance must be performed. Cell 'Input'!$F$32 allows the user to enter the amount of time allowed to accumulate on the proposed engine configuration before scheduled maintenance must be performed. This interval represents an opportunity to incorporate the change.

Since all contractor engine programs do not track scheduled inspections the same way, users are given an option to choose the units of the scheduled maintenance interval. Options are illustrated in Table 1.

Option	**Input**
Total Accumulated Cycles	"TAC"
Total Operating Time	"TOT"
Engine Flying Hours	"EFH"
Conversion Factor	Any Numerical Value

Table 1. Possible Units of the Scheduled Maintenance Interval.

Cell 'Input'!$D$32 is used to input the units option for the scheduled maintenance interval.

2. Line 17.0 Calculated Scheduled Maintenance Interval Rate/1000 EFH (CurCalSchMaintInt and ProCalSchMaintInt)

CurCalSchMaintInt and ProCalSchMaintInt are not input elements. They are derived by dividing the product of the amount of time accumulated on the engine, in the selected units, and 1000 by the time between scheduled preventative maintenance actions.

The formulas used to derive these variables are based on the units of the scheduled maintenance interval selected on Line 16.0. The cell formula for CurCalSchMaintInt in cell 'Input'!$E$33 is

[Cell 'Input'!$E$33 = IF(Cell 'Input'!D32 = "TAC", (Cell 'Standard History'!D63 * 1000) / CurSchMaintInt, IF(Cell 'Input'!D32 = "TOT", (Cell 'Standard History'!D64 * 1000) / CurSchMaintInt, IF(Cell 'Input'!D32 = "EFH", 1000 / CurSchMaintInt, IF(TYPE(D32)) = 1, (Cell 'Input'!D32 * 1000) / CurSchMaintInt, "Bad Units/EFH")))))].

This equals

[Cell 'Input'!$E$33= IF(Cell 'Input'!D32 = "TAC", (Cell 'Standard History'!D63 * 1000) / Cell 'Input'!E32, IF(Cell 'Input'!$D$32 = "TOT", (Cell 'Standard History'!D64 * 1000) / Cell 'Input'!E32, IF(Cell 'Input'!D32 = "EFH", 1000 / Cell 'Input'!E32, IF(TYPE(D32) = 1, (Cell 'Input'!D32 * 1000) / Cell 'Input'!E32, "Bad Unit/EFH))))].

The cell formula for ProCalSchMaintInt in cell 'Input'!$F$33 is

[Cell 'Input'!$F$33 = IF(Cell 'Input'!D32 = "TAC", (Cell 'Standard History'!D63 * 1000) / ProSchMaintInt, IF(Cell 'Input'!D32 = "TOT", (Cell 'Standard History'!D64 * 1000) / ProSchMaintInt, IF(Cell 'Input'!D32 = "EFH", 1000 / ProSchMaintInt, IF(TYPE(D32)) = 1, (Cell 'Input'!D32 * 1000)/ ProSchMaintInt, "Bad Units/EFH")))))].

This equals

[Cell 'Input'!$F$33= IF(Cell 'Input'!D32 = "TAC", (Cell 'Standard History'!D63 * 1000) / Cell 'Input'!F32, IF(Cell 'Input'!D32 = "TOT", (Cell 'Standard History'!D64 * 1000) / Cell 'Input'!F32, IF(Cell 'Input'!D32 = "EFH", 1000 / Cell 'Input'!F32, IF(TYPE(D32) = 1, (Cell 'Input'!D32 * 1000) / Cell 'Input'!F32, "Bad Unit/EFH))))].

Cell 'Input'!$D$32 is used to input the units option for the scheduled maintenance interval.

Cell 'Standard History'!$D$63 is labeled TacEfh and represents the ratio of the expected annual engine total accumulated cycles (TAC) to the expected annual engine flight hours (EFH). Users may modify the TacEfh value by changing the value entered in row 23 of the applicable standard fleet in the Std_hist.xls file.

Cell 'Standard History'!$D$64 is labeled TotEfh and represents the ratio of the expected annual engine total operating time (TOT) to the expected annual engine flight hours (EFH). Users may modify the TotEfh value by changing the value entered in row 24 of the applicable standard fleet in the Std_hist.xls file.

Cell 'Input'!$E$32 is labeled CurSchMaintInt and allows the user to enter the amount of time allowed to accumulate on the current engine configuration before scheduled maintenance must be performed.

Cell 'Input'!$F$32 is labeled ProSchMaintInt and allows the user to enter the amount of time allowed to accumulate on the proposed engine configuration before scheduled maintenance must be performed.

The IF statement uses the following logic to determine the calculated scheduled maintenance interval rate per 1000 engine flight hours where the scheduled maintenance interval represents either the current or proposed configuration variables:

A) If the user selected total accumulated cycles as the units per 1000 engine flight hours, then the value displayed is the product of the total accumulated cycles per 1000 engine flight hours and 1000 divided by the scheduled maintenance interval for the engine.

B) If the user selected total operating time as the units per 1000 engine flight hours, then the value displayed is the product of the engines total operating time per 1000 engine flight hours and 1000 divide by the scheduled maintenance interval for the engine.

C) If the user selected engine flight hours as the units per 1000 engine flight hours, then the value displayed is 1000 divided by the scheduled maintenance interval for the engine.

D) If the user selected a conversion factor, equal to some numerical value, then the value displayed is the product of the numerical value and 1000 divide by the scheduled maintenance interval for the engine.

E) If the user did not properly enter one of the scheduled maintenance interval unit options, then the cell returns the error message "Bad Units/EFH".

3. Line 18.0 Scheduled Manhours at O Level (CurSchMhInspOlev and ProSchMhInspOlev)

CurSchMhInspOlev and ProSchMhInspOlev are entered directly into cells 'Input'!$E$34 and 'Input'!$F$34 and are the estimates of the number of hours required to inspect the engine, related to the change, during scheduled maintenance at the Organizational level.

4. Line 19.0 Scheduled % Removed at O & I Level (CurSchPctRemOILev and ProSchPctRemOILev)

Entered in cells 'Input'!$E$35 and 'Input'!$F$35, CurSchPctRemOILev and ProSchPctRemOILev represent the percentage of time a scheduled event will require either removal or replacement of the engine component being modified at the Organizational or Intermediate level.

5. Line 20.0 Scheduled Manhours to Remove/Replace at O Level (CurSchMhRrOLev and ProSchMhRrOLev)

CurSchMhRrOLev and ProSchMhRrOLev are entered into cells 'Input'!$E$36 and 'Input'!$F$36 and symbolize the estimated manhours to remove or replace the component being modified during scheduled maintenance at the Organizational level.

6. Line 21.0 Scheduled Manhours at I Level (CurSchMhIlev and ProSchMhIlev)

Directly entered into cells 'Input'!$E$37 and 'Input'!$F$37, CurSchMhIlev and ProSchMhIlev represent the estimated number of manhours required to complete any scheduled maintenance on the component being modified at the Intermediate level.

7. Line 22.0 Scheduled % at O & I requiring Repair (CurSchPctRepOIlev and ProSchPctRepOIlev)

Cells 'Input'!$E$38 and 'Input'!$F$38, labeled CurSchPctRepOIlev and ProSchPctRepOIlev, represent the percentage of time a scheduled maintenance event will require material cost at the Organizational and Intermediate levels.

8. Line 23.0 Scheduled Repair Cost at O & I level (CurSchRepOIlevCost and ProSchRepOIlevCost)

CurSchRepOIlevCost and ProSchRepOIlevCost are entered in cells 'Input'!$E$39 and 'Input'!$F$39 and represent the expected cost of scheduled maintenance at the Organizational and Intermediate levels.

9. Line 24.0 Scheduled % Returned to Depot (CurSchPctRetDepot and ProSchPctRetDepot)

CurSchPctRetDepot and ProSchPctRetDepot are entered in cells 'Input'!$E$40 and 'Input'!$F$40 and are the estimate of the percentage of components that require scheduled maintenance that cannot be performed at the Organizational and Intermediate levels.

10. Line 25.0 Scheduled Manhours at Depot (CurSchMhDepot and ProSchMhDepot)

Entered in cells 'Input'!$E$41 and 'Input'!$F$41, CurSchMhDepot and ProSchMhDepot represent the manhours required to complete a scheduled maintenance event on the component at the Depot level.

11. Line 26.0 Scheduled % at Depot requiring Repair (CurSchPctDepotRep and ProSchPctDepotRep)

Cells 'Input'!$E$42 and 'Input'!$F$42, labeled CurSchPctDepotRep and ProSchPctDepotRep, are entered by the user and are the estimates for the percentage of time a scheduled event will require material cost at the Depot level.

12. Line 27.0 Scheduled Repair Cost at Depot (CurSchRepDepotCost and ProSchRepDepotCost)

CurSchRepDepotCost and ProSchRepDepotCost are entered into cells 'Input'!$E$43 and 'Input'!$F$43 and represent the material cost of a scheduled event on the component at the Depot level.

13. Line 28.0 Scheduled % Scrapped (CurSchPctScrap and ProSchPctScrap)

CurSchPctScrap and ProSchPctScrap are entered into cells 'Input'!$E$44 and 'Input'!$F$44 and are the estimates of the percentage of time the component will be scrapped during a scheduled event.

14. Line 29.0 Hardware Cost to Scrap (CurSchPartScpCost and ProSchPartScpCost)

Cells 'Input'!$E$45 and 'Input'!$F$45, labeled CurSchPartScpCost and ProSchPartScpCost, represent the replacement cost of scrapping a component required by scheduled maintenance. The replacement component is assumed to be a new unit purchased for that purpose.

15. Line 30.0 Scheduled Engine Test Time (CurSchEngTstTime and ProSchEngTstTime)

CurSchEngTstTime and ProSchEngTstTime are entered in cells 'Input'!$E$46 and 'Input'!$F$46 and are estimates of the expected number of hours needed to test the engine after scheduled maintenance. CurSchEngTstTime and ProSchEngTstTime assume there are two base level manhours per test hour for labor costs.

D. DESCRIPTION OF UNSCHEDULED INPUT PARAMETERS LINE 31.0 THROUGH LINE 47.0

The seventeen input parameters in this section deal with unscheduled events. The format consists of two columns, one representing the current engine configuration (column E) and the other representing the proposed engine configuration (column F). The percentages in this section refer to the percentage of all unscheduled events for a given year.

1. Line 31.0 Unscheduled Event Rate/1000 EFH (CurUnschEvtRate and ProUnschEvtRate)

CurUnschEvtRate and ProUnschEvtRate are entered into cells 'Input'!$E$48 and 'Input'!$F$48 and represent the rate at which the component is expected to fail per 1000 engine flight hours.

The definition of "failure" is not mandated by the model. For each CEA, the contractor may provide a specific definition of failure. The failure rate may represent inherent failures, induced failures, or both and may be only applicable to a single engine part or component, a group of engine parts or components, or the whole engine. This rate also represents failures at all levels of maintenance and is the reciprocal of the mean time between failures (MTBF) of the engine. (Reeves, 1993, p. 21)

2. Line 32.0 Unscheduled Manhours at O Level (CurUnschMhOlev and ProUnschMhOlev)

CurUnschMhOlev and ProUnschMhOlev are entered in cells 'Input'!$E$49 and 'Input'!$F$49 and are the number of man-hours required to inspect the component associated with an unscheduled maintenance event at the Organizational level.

3. Line 33.0 Unscheduled % Removed at O & I Level (CurUnschPctRemOILev and ProUnschPctRemOILev)

CurUnschPctRemOILev and ProUnschPctRemOILev are entered into cells 'Input'!$E$50 and 'Input'!$F$50. Each value is the user's estimate of the percentage of time an unscheduled maintenance event will require the removal and replacement of the component being modified at the Organizational and Intermediate levels.

4. Line 34.0 Unscheduled Manhours to Remove/Replace at O Level (CurUnschMhRrOlev and ProUnschMhRrOlev)

Input into cells 'Input'!$E$51 and 'Input'!$F$51, CurUnschMhRrOlev and ProUnschMhRrOlev represent the number of man-hours expected to remove and replace the component when required during an unscheduled event at the Organizational level.

5. **Line 35.0 Unscheduled Manhours at I level (CurUnschMhIlev and ProUnschMhIlev)**

CurUnschMhIlev and ProUnschMhIlev, entered into cells 'Input'!$E$52 and 'Input'!$F$52, represent the number of man-hours required to repair the modified component at the Intermediate level during unscheduled maintenance.

6. **Line 36.0 Unscheduled % at O & I requiring Repair (CurUnschPctRepOIlev and ProUnschPctRepOIlev)**

CurUnschPctRepOIlev and ProUnschPctRepOIlev are entered into cells 'Input'!$E$53 and 'Input'!$F$53 and are the user's estimates of the percentage of time an unscheduled maintenance event will require material cost at the Organizational and Intermediate levels.

7. **Line 37.0 Unscheduled Repair Cost at O & I level (CurUnschRepOIlevCost and ProUnschRepOIlevCost)**

CurUnschRepOIlevCost and ProUnschRepOIlevCost are entered into cells 'Input'!$E$54 and 'Input'!$F$54 and represent the cost of materials required for an unscheduled maintenance event at the Organizational and Intermediate levels.

8. **Line 38.0 Unscheduled % Returned to Depot (CurUnschPctRetDepot and ProUnschPctRetDepot)**

Cells 'Input'!$E$55 and 'Input'!$F$55, labeled CurUnschPctRetDepot and ProUnschPctRetDepot, represent the percentage of components that require maintenance during an unscheduled event that can not be performed at the Organizational or Intermediate levels.

9. Line 39.0 Unscheduled Manhours at Depot (CurUnschMhDepot and ProUnschMhDepot)

CurUnschMhDepot and ProUnschMhDepot are entered in cells 'Input'!$E$56 and 'Input'!$F$56 and represent the number of manhours required for unscheduled maintenance of a component at the Depot level.

10. Line 40.0 Unscheduled % at Depot requiring Repair (CurUnschPctDepotRep and ProUnschPctDepotRep)

CurUnschPctDepotRep and ProUnschPctDepotRep are entered into cells 'Input'!$E$57 and 'Input'!$F$57 and represent the user's estimate of the percentage of time an unscheduled event will require material cost at the Depot level.

11. Line 41.0 Unscheduled Repair Cost at Depot (CurUnschRepDepotCost and ProUnschRepDepotCost)

Cells 'Input'!$E$58 and 'Input'!$F$58 are CurUnschRepDepotCost and ProUnschRepDepotCost and represent the material cost of an unscheduled maintenance event at the Depot level.

12. Line 42.0 Unscheduled % Scrapped (CurUnschPctScrap and ProUnschPctScrap)

CurUnschPctScrap and ProUnschPctScrap, entered in cells 'Input'!$E$59 and 'Input'!$F$59, are the percentage of time an unscheduled maintenance event will discover a component beyond economical repair.

13. Line 43.0 Hardware Cost to Scrap (CurUnschPartScpCost and ProUnschPartScpCost)

CurUnschPartScpCost and ProUnschPartScpCost are entered in cells 'Input'!$E$60 and 'Input'!$F$60 and represent the user's estimate of the cost to replace a component which was scrapped as a result of unscheduled maintenance. CurUnschPartScpCost and ProUnschPartScpCost assume the scrapped component will be replaced by a new unit.

CurUnschPartScpCost and ProUnschPartScpCost do not account for the cost of disposing the scrapped unit. (Davis, 1991, p. 35)

14. Line 44.0 Unscheduled Engine Test Time (CurUnschEngTstTime and ProUnschEngTstTime)

CurUnschEngTstTime and ProUnschEngTstTime are entered directly into cells 'Input'!$E$61 and 'Input'!$F$61 and represent the number of hours required to test an engine after an unscheduled maintenance event. They assume there are two base level manhours per test hour for labor costs.

15. Line 45.0 Unscheduled Secondary Damage Costs (CurUnschSecDamCost and ProUnschSecDamCost)

CurUnschSecDamCost and ProUnschSecDamCost are entered into cells 'Input'!$E$62 and 'Input'!$F$62 and represent the cost of damage to other engine parts or components caused by failure of the component being modified.

CurUnschSecDamCost and ProUnschSecDamCost assume that the labor cost for repair of the failed unit will also cover labor for repair of the secondary damage. If this is not the case, then costs for repairing the secondary damage is included in this cost. (Davis, 1991, p. 35)

16. Line 46.0 Unscheduled Incidental Costs (CurUnschIncidentalCost and ProUnshIncidentalCost)

CurUnschIncidentalCost and ProUnschIncidentalCost are entered in cells 'Input'!$E$63 and 'Input'!$F$63 and are estimates of any expected incidental costs for each unscheduled maintenance event not covered by any other input element.

17. Line 47.0 Number of P/N's (CurPartNums and ProPartNums)

CurPartNums and ProPartNums are entered into cells 'Input'!$E$64 and 'Input'!$F$64. Cell 'Input'!$E$64 represents the number of parts to be removed from the supply system under the current configuration if the change is incorporated. Cell 'Input'!$F$64 represents the number of parts to be added to the supply system under the proposed configuration if the change is incorporated.

E. DESCRIPTION OF THE OPTIONAL INPUT PARAMETERS LINE 48.0 THROUGH LINE 50.0

The Optional Input section deals with three optional input parameters that reflect expected improvements in the proposed configuration. The format consists of one column (column F) representing the proposed engine configuration.

1. Line 48.0 % Improvement in Specific Fuel Consumption from Current to Proposed (PctImpSFC)

PctImpSFC is entered in cell 'Input'!$F$66 and represents the percentage improvement in specific fuel consumption of the proposed configuration over the current configuration.

2. Line 49.0 Aircraft Loss Rate Improvement / 1,000,000 EFH (AClossImprove)

AClossImprove is entered into cell 'Input'!$F$67 and represents the improvement in the number of Class A mishaps, per one million engine flight hours (EFH), with the proposed engine configuration. The savings are only shown for whole aircraft saved.

Class A mishaps refer to those directly attributable to the component being modified. This frequency is best described as an attempt to account for the cost of losing the aircraft due to an unscheduled failure of the component. (Reeves, 1993, p. 27)

3. Line 50.0 Engineering Development Cost (EngineeringDevelopCost)

EngineeringDevelopCost is entered in cell 'Input'!$F$68 and represents the future cost to fund the design and verification of a task related to the component being modified.

F. DESCRIPTION OF THE STANDARD INPUT VALUES

The Standard Input section describes thirteen standard input values that are used throughout the model. Standard input values are provided by the government to the contractors. These values are extracted from the applicable standard fleet located in the Std_hist.xls file. The values are entered into the Std_hist.xls file by the user prior to loading, see the CEA Model Version 3.0 User's Guide, Chapter 3 for detailed instructions.

Each service provides the contractors with updated information each fiscal year. Since three services use the CEA Model, there are three sources of information. Chapter 6 of the CEA Model Version 3.0 User's Guide outlines where each of the services gets this information.

Fiscal Year Dollars (YrDollar) is displayed in cell 'Input'!$G$8 and represents the base year for the calculation of net present value in the model. To change YrDollar, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 8.

NPV Rate (NPVrate) is displayed in cell 'Input'!$G$9 and represents the discount rate used in the model's net present value calculations. Net present value (NPV) is the difference between the discounted present value of benefits and the discounted present value of costs. The NPV rate to be used in evaluating Federal activities is given in OMB circular A-94. To change NPVrate, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 9.

Labor Cost / Manhour at O & I (LaborCostOI) is displayed in cell 'Input'!$G$11 and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Labor Cost / Manhour at Depot (LaborCostDepot) is displayed in cell 'Input'!$G$12 and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

Cost to Introduce new P/N - $/PN is displayed in cell 'Input'!$G$14 and represents the cost to introduce a new part into the supply system. To change this value, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 14.

Cost to Maintain each P/N / Year (PnMatinCost) is displayed in cell 'Input'!$G$15 and represents the annual cost to maintain each part number in the supply system. To change PnMatinCost, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 15.

Fuel Cost / Gallon (FuelCostGal) is displayed in cell 'Input'!$G$17 and represents the cost of fuel per gallon. To change FuelCostGal, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 17.

Test Fuel - Gallon / Hour (TestFuelGH) is displayed in cell 'Input'!$G$19 and represents the fuel consumption rate during engine testing. This value is based on the gallons of fuel used per hour of testing. This value is obtained from 'Standard Histoy'!G62. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Flight Fuel - Gallon / Hour is displayed in cell 'Input'!$G$20 and represents the fuel consumption rate during flight in gallons per hour. This value is obtained from 'Standard History'!G63 labeled FltFuelGH. To change FltFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 20.

EFH / Year is displayed in cell 'Input'!$G$22 and represents the number of engine flight hours (EFH) per engine per year. This value is obtained from 'Standard History'!D62 labeled EfhYr. To change EfhYr, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 22.

TAC / EFH Ratio is displayed in cell 'Input'!$G$23 and represents the ratio of total accumulated cycles (TAC) to engine flight hours (EFH). This value is obtained from 'Standard History'!D63 labeled TacEfh. To change TacEfh, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 23.

TOT / EFH Ratio is displayed in cell 'Input'!$G$24 and represents the ratio of total operating time (TOT) to engine flight hours (EFH). This value is obtained from 'Standard History'!D64 labeled TotEfh. To change TotEfh, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 24.

Aircraft Cost is displayed in cell 'Input'!$G$26 and represents the cost, in fiscal year dollars, of the aircraft in which the modification is being done. This value is obtained from 'Standard History'!G64 labeled AirCraftCost. To change AirCraftCost, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 26.

G. DESCRIPTION OF THE CHANGE DESCRIPTION BOX

A Change Description Box is provided at the bottom of the Input Sheet. Cells 'Input'!$C$85 to 'Input'!$C$94 are provided to allow the user to describe the change with text. The Change Description Box is displayed on the Summary Sheet in cells 'Summary'!$C$8 through 'Summary'!$C$17.

IV. DESCRIPTION OF THE STANDARD HISTORY SHEET

A. INTRODUCTION

The Standard History sheet contains page 2 of the model and is identified by the worksheet tab labeled 'Standard History'. The Standard History sheet contains basic information about the engine that is used to calculate the aircraft flying hour schedule and fuel usage. The worksheet is made up of two parts.

The first part consists of ten columns, B through J, that describe the aircraft flying schedule and engine availability for modification. Annual calculations are performed in these columns from row 14 to row 60, allowing the analysis to cover up to 45 years.

The second part of the page consists of additional information about the engine located on the bottom three rows.

To modify the Standard History sheet users must make changes to the standard history spreadsheet file entitled Std_Hist.xls. The CEA Model Version 3.0 User's Guide, Chapter 4, details procedures for making changes to that spreadsheet file.

This chapter provides a description of each column of page 2 and its associated worksheet and provides a detailed look at the formulas and variables used in making any calculations.

B. CALENDAR YEAR - COLUMN B

The Calendar Year column lists the years over which the analysis will be completed. Cell 'Standard History'!$B$14 is labeled FirstYrStdHistory, displays the first year of the analysis and is entered by the user in cell 32 of the applicable standard fleet in the Std_hist.xls file. The formulas in the cells representing subsequent years add one year to the previous year. The formula in cell 'Standard History'!$B$15 is given as an example:

[Cell 'Standard History'!$B$15 = 1 + FirstYrStdHistory].

This equals

[Cell 'Standard History'!$B$15 = 1 + Cell 'Standard History' !B14].

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

C. NO. OF AVAILABLE MOD MONTHS - COLUMNS C AND D

1. Production (Column C)

Column C calculates the number of months during each year that the modification will be incorporated into production engines. The formula in cell 'Standard History'!$C$14, labeled MoAvailProd, is

[Cell 'Standard History'!$C$14 = IF(Cell 'Input'!$D$28 = FirstYrStdHistory, 13 - Cell 'Input'!$F$28, IF(Cell 'Input'!$D$28 > FirstYrStdHistory, 0, 12))].

This equals

[Cell 'Standard History'!$C$14 = IF(Cell 'Input'!$D$28 = Cell 'Standard History'!B14, 13 - Cell 'Input'!$F$28, IF (Cell 'Input'!$D$28 > Cell 'Standard History'!B14, 0, 12))].

Cell 'Input'!$D$28 is labeled ProdIncorpYr and represents the first year the change will be incorporated into engines in production.

FirstYrStdHistory is cell 'Standard History'!$B$14, represents the first year of the analysis and is entered by the user in cell 32 of the applicable standard fleet in the Std_hist.xls file.

Cell 'Input'!$F$28 is labeled ProdIncorpMo and represents the month that the change will begin to be incorporated into engines in production.

The IF statement uses the following logic to determine the number of months available, during each year, to incorporate the modification into production engines:

A) The first year the incorporation in production takes place is compared to the current year. If these two years are equal, then the number of months available is 13 minus the month that the change will begin to be incorporated into engines in production (January = 1).

B) If the first year of production incorporation does not equal the current year, then the number of months available during that year to make production modifications is:

1) Zero, if the first year production incorporation begins is greater than the current year. In other words, modification during production has not yet begun and will not begin during the current year, or

2) Twelve, if the first year production incorporation begins is not greater than the current year. In other words, all twelve months of the current year are available to incorporate modifications during production.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

2. Field (Column D)

Column D calculates the number of months during each year that the modification will be incorporated into engines in the field. The formula in cell 'Standard History'!$D$14, labeled MoAvailFieldMod, is

[Cell 'Standard History'!$D$14 = IF(Cell 'Input'!$D$29 = FirstYrStdHistory, 13 - Cell 'Input'!$F$29, IF(Cell 'Input'!$D$29 > FirstYrStdHistory, 0, 12))].

This equals

[Cell 'Standard History'!$D$14 = IF(Cell 'Input'!$D$29 = Cell 'Standard History'!B14, 13 - Cell 'Input'!$F$29, IF (Cell 'Input'!$D$29 > Cell 'Standard History'!B14, 0, 12))].

Cell 'Input'!$D$29 is labeled FieldIncorpYr and represents the first year the change will be incorporated into engines in the field.

Cell 'Input'!$F$29 is labeled FieldIncorpMo and represents the month that the change will begin to be incorporated into engines in the field.

FirstYrStdHistory is cell 'Standard History'!$B$14 and represents the first year of the analysis and is entered by the user in cell 32 of the applicable standard fleet in the Std_hist.xls file.

The IF statement uses the following logic to determine the number of months available, during each year, to incorporate the modifications into engines in the field:

A) The first year field incorporation takes place is compared to the current year. If these two years are equal, then the number of months available is 13 minus the month that the change will begin to be incorporated into engines in the field (January = 1).

B) If the first year of field incorporation does not equal the current year, then the number of months available during that year to make field modifications is:

1) Zero, if the first year field incorporation occurs is greater than the current year. In other words, modification to engines in the field has not yet begun and will not begin this year, or

2) Twelve, if the first year field incorporation occurs is not greater than the current year. In other words, all twelve months of the current year are available to make modifications in the field.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

The last three rows of column D display the following information drawn from the Std_hist.xls file standard fleet information:

EFH / Year (EfhYr) is the expected number of engine flight hours (EFH) per year and is displayed in cell 'Standard History'!$D$62. Users may modify the EfhYr value by changing the value entered in row 22 of the applicable standard fleet in the Std_hist.xls file.

TAC / EFH (TacEfh) is the ratio of the expected annual engine total accumulated cycles (TAC) to the expected annual engine flight hours (EFH) and is displayed in cell 'Standard History'!$D$63. Users may modify the TacEfh value by changing the value entered in row 23 of the applicable standard fleet in the Std_hist.xls file.

TOT / EFH (TotEfh) is the ratio of the expected annual engine total operating time (TOT) to the expected annual engine flight hours (EFH) and is displayed in cell 'Standard History'!$D$64. Users may modify the TotEfh value by changing the value entered in row 24 of the applicable standard fleet in the Std_hist.xls file.

D. ENGINE DELIVERIES - COLUMNS E AND F

1. Annual (Column E)

Column E displays the number of new engines delivered to the fleet and engines retired while in the fleet during each year of the analysis. The variable in cell 'Standard History'!$E$14 is labeled CurYrEngDel.

Users may modify the CurYrEngDel value by changing the values entered in rows 32 to 76 in the Std_hist.xls file which indicate the deliveries in each year of the analysis. To retire engines, the user would enter a negative sign in front of this value. The CEA Model Version 3.0 User's Guide, Chapter 5, discusses the reasoning and implications of this procedure.

The total number of engines delivered over the period analyzed is displayed in cell 'Standard History'!$E$60 and is labeled TotEngDel. TotEngDel is obtained from cell 'Standard History'!$K$6.

2. **Cumulative (Column F)**

Column F calculates the expected cumulative number of engines in service. The column makes the simple assumption that the engines delivered are added at the beginning of the year and the engines lost through attrition are removed at the end of the year. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives. The formula in cell 'Standard History'!$F$14, labeled CurYrEngDelCum, is

[Cell 'Standard History'!$F$14 = IF(PrevYrEngDelCum - PrevYrAttritWholeEng + CurYrEngDel > 1, PrevYrEngDelCum - PrevYrAttritWholeEng + CurYrEngDel, 0)].

This equals

[Cell 'Standard History'!$F$14 = IF(Cell 'Standard History'!F13 - Cell 'Standard History'!J13 + Cell 'Standard History'!E14 > 1, Cell 'Standard History'!F13 - Cell 'Standard History'!J13 + Cell 'Standard History'!E14, 0)].

PrevYrEngDelCum is cell 'Standard History'!$F$13, equals zero and is only used as a place holder to begin the column F calculations. In this context, it represents the total number of engines in service at the end of the previous year.

PrevYrAttritWholeEng is cell 'Standard History'!$J$13, equals zero and is also only used as a place holder to begin the column J calculations. In this context, it represents the number of engines lost through attrition in the previous year.

CurYrEngDel is cell 'Standard History'!$E$14 and represents the number of new engines delivered to the fleet and the number of engines retired while in the fleet during the current year.

The IF statement uses the following logic to determine the cumulative number of engines in service each year:

A) If the total number of engines delivered the previous year minus the number of engines lost through attrition in the previous year plus the number of engines delivered in the current year is greater than one, then the value displayed is the quantity equal to the total number of engines delivered the previous year minus the number of engines lost through attrition in the previous year plus the number of engines delivered in the current year.

B) If the total number of engines delivered the previous year minus the number of engines lost through attrition in the previous year plus the number of engines delivered in the current year is less than or equal to one, then the value displayed is zero.

The cell formula for the next year is

```
[Cell 'Standard History'!$F$15 = IF(CurYrEngDelCum -
CurYrAttritWholeEng + Cell 'Standard History'!E15  > 1,
CurYrEngDelCum - CurYrAttritWholeEng + Cell 'Standard
History'!E15, 0)].
```

This equals

```
[Cell 'Standard History'!$F$15 = IF(Cell 'Standard
History'!F14  - Cell 'Standard History'!J14 + Cell 'Standard
History'!E15  > 1, Cell 'Standard History'!F14  - Cell
'Standard History'!J14 + Cell 'Standard History'!E15, 0)].
```

CurYrEngDelCum is cell 'Standard History'!$F$14 and represents the cumulative number of engines in the fleet the previous year.

CurYrAttritWholeEng is cell 'Standard History'!$J$14 and represents, in this context, the number of engines lost through attrition from the fleet in the previous year.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

E. ANNUAL ENGINE FLIGHT HOURS - COLUMNS G AND H

1. Fleet (Column G)

Column G calculates or displays the expected average total whole number of engine hours expected to be flown each year. The column entry is *displayed* if Custom EFH is used for that year in the applicable standard fleet of the Std_hist.xls file. The column entry is *calculated* if Custom EFH is not used for that year in the applicable standard fleet of the Std_hist.xls file.

a. Custom EFH Is Not Used

If Custom EFH is not used for the applicable year in the Std_hist.xls file, column G will calculate the expected average total whole number of engine hours flown each year. The formula in cell 'Standard History'!$G$14, labeled AnnualFleetEfh, is

[Cell 'Standard History'!$G$14 = TRUNC((PrevYrEngDelCum + CurYrEngDelCum) / 2) * $EfhYr)].

This equals

[Cell 'Standard History'!$G$14 = TRUNC((Cell 'Standard History'!F13 + Cell 'Standard History'!F14) / 2) * Cell 'Standard History'!$D$62)].

PrevYrEngDelCum is cell 'Standard History'!$F$13, equals zero and is only used as a place holder to begin the column F calculations. In this context, it represents the cumulative number of engines in the fleet during the previous year.

CurYrEngDelCum is cell 'Standard History'!$F$14 and represents the cumulative number of engines in the fleet during the current year.

EfhYr is the expected number of engine flight hours (EFH) per year and is displayed in cell 'Standard History'!$D$62.

TRUNC is an EXCEL worksheet function which truncates a number to an integer by removing the fractional part of the number.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

Cell 'Standard History'!$G$60 represents the total expected number of fleet engine hours flown over the period of the analysis. The cell formula is

[Cell 'Standard History'!$G$60 = SUM(Cell 'Standard History'!G14: Cell 'Standard History'!G58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

b. Custom EFH Is Used

If Custom EFH is used in the Std_hist.xls file, column G will simply display the number of engine flight hours entered for that year from the applicable standard fleet.

Cell 'Standard History'!$G$60 represents the total expected number of fleet engine hours flown over the period of the analysis. The cell formula is

[Cell 'Standard History'!$G$60 = SUM(Cell 'Standard History'!G14: Cell 'Standard History'!G58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

c. Fuel and Aircraft Cost Information

The last three rows of the column contain information regarding fuel and aircraft cost obtained from the applicable standard fleet in the Std_hist.xls file.

Test Fuel - Gallons / Hour (TestFuelGH) is displayed in cell 'Standard History'!$G$62 and represents the fuel consumption rate during engine testing. TestFuelGH is based on the gallons of fuel used per hour of testing, not necessarily engine run time. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Flight Fuel - Gallon / Hour (FltFuelGH) is displayed in cell 'Standard History'!$G$63 and represents the fuel consumption rate during flight in gallons per hour. To change FltFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 20.

Aircraft Cost (AirCraftCost) is displayed in cell 'Standard History'!$G$64 and represents the cost, in fiscal year dollars, of the aircraft in which the modification is being incorporated. To change AirCraftCost, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 26.

2. Average per Engine (Column H)

Column H calculates the expected average annual flight hours flown by each engine for each year of the analysis and is determined by dividing the expected average total whole number of engine hours flown in the current year by the expected average number of engines in the fleet. The formula in cell 'Standard History'!$H$14, labeled YrEfhPerEng, is

[Cell 'Standard History'!$H$14 = IF(CurYrEngDelCum = 0, $EfhYr, AnnualFleetEfh / ((CurYrEngDelCum + PrevYrEngDelCum) / 2))].

This equals

[Cell 'Standard History'!$H$14 = IF(Cell 'Standard History'!F14 = 0, Cell 'Standard History'!$D$62, Cell 'Standard History'!G14 / ((Cell 'Standard History'!F14 + Cell 'Standard History'!F13) / 2))].

CurYrEngDelCum is cell 'Standard History'!$F$14 and represents the cumulative number of engines in the fleet during the current year.

EfhYr is the expected number of engine flight hours (EFH) per year and is displayed in cell 'Standard History'!$D$62.

AnnualFleetEfh is the average total whole number of engine hours flown in the current year and is displayed in cell 'Standard History'!$G$14.

PrevYrEngDelCum is cell 'Standard History'!$F$13, equals zero and is only used as a place holder to begin the column F calculations. In this context, it represents the cumulative number of engines in the fleet during the previous year.

The IF statement uses the following logic to determine the average annual engine flight hours per engine for each year of the analysis:

A) If the cumulative number of engines in the fleet in the current year is zero, then the value displayed equals the expected number of engine flight hours per year.

B) If the cumulative number of engines in the fleet does not equal zero, then the number displayed is the average total whole number of engine hours flown during the current year divided by the average number of engines in the fleet in the current year.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

F. ATTRITION - COLUMNS I AND J

1. Cumulative Engines (Column I)

Column I calculates the expected cumulative number of engines lost through attrition throughout the period of the analysis. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives and is determined by adding the previous years' cumulative number of engines lost to attrition to the current year's number of engines lost to attrition. The current year's attrition is determined by multiplying the number of engine hours flown in the year by the engine attrition rate per engine flying hour. The formula in cell 'Standard History'!$I$14, labeled CurYrAttritCumEng, is

[Cell 'Standard History'!$I$14 = $EngAttritEfh * AnnualFleetEfh + PrevYrAttritCumEng].

This equals

[Cell 'Standard History'!$I$14 = Cell 'Standard History'!$I$62 * Cell 'Standard History'!G14 + Cell 'Standard History'!I13].

EngAttritEfh is displayed in cell 'Standard History'!$I$62 and represents the attrition rate per engine flight hour.

AnnualFleetEfh is the average total whole number of engine hours flown in the current year and is displayed in cell 'Standard History'!$G$14.

PrevYrAttritCumEng is displayed in cell 'Standard History'!$I$13 and is only used as a place holder to begin the column I calculations. In this context, it represents the cumulative number of engines lost through attrition through the end of the last year.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

Engine Attrition / EFH (EngAttritEfh) is displayed in cell 'Standard History'!$I$62 and is the last functional cell of column I. This variable represents the attrition rate per engine flight hour and is obtained from row 28 of the applicable standard fleet in the Std_hist.xls file. Users wishing to change this value must do so in the Std_hist.xls file. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives.

2. Annual Engines (Column J)

Column J calculates the number of engines lost through attrition in the current year and does so by subtracting the cumulative number of engines lost through attrition through the end of the previous year from the cumulative number of engines lost through attrition through the end of the current year. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives. The formula in cell 'Standard History'!$J$14, labeled CurYrAttritWholeEng, is

[CurYrAttritWholeEng = CurYrAttritCumEng - PrevYrAttritCumEng].

This equals

[Cell 'Standard History'!$J$14 = Cell 'Standard History'!I14 - Cell 'Standard History'!I13].

CurYrAttritCumEng is cell 'Standard History'!$I$14 and represents the cumulative number of engines lost through attrition through the end of the current year.

PrevYrAttritCumEng is displayed in cell 'Standard History'!$I$13 and is only used as a place holder to begin the column I calculations. In this context, it represents the cumulative number of engines lost through attrition through the end of the previous year.

The cell formula for each subsequent year is similar with the relative references in each cell increasing by one.

Cell 'Standard History'!$J$60 represents the total expected number of engines lost through attrition during the period of the analysis. The cell formula is

[Cell 'Standard History'!$J$60 = SUM(Cell 'Standard History'!J14: Cell 'Standard History'!J58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

G. BLUE CALCULATIONS - COLUMN K

Column K calculates the total expected number of engines delivered over the period of the analysis by checking for positive values in the annual engine deliveries column (column E). By summing only the positive values, it adds only engines delivered to the total and disregards engines retired (negative values). The formula in cell 'Standard History'!$K$14 is

[Cell 'Standard History'!$K$14 = IF(CurYrEngDel > 0, CurYrEngDel, 0)].

This equals

[Cell 'Standard History'!$K$14 = IF(Cell 'Standard History'!E14 > 0, Cell 'Standard History'!E14, 0)].

CurYrEngDel is displayed in cell 'Standard History'!$E$14 and represents the number of new engines delivered to the fleet and the number of engines retired while in the fleet during the current year.

The IF statement uses the following logic to determine the number of new engines delivered to the fleet each year of the analysis:

A) If the number of engines delivered or retired during the current year is greater than zero, then the number displayed represents the number of aircraft delivered.

B) If the number of engines delivered or retired during the current year is less than or equal to zero, than the number of aircraft delivered is zero.

The cell formulas for the subsequent years through cell 'Standard History'!$K$58 are similar with each cell's relative references increasing by one.

Cell 'Standard History'!$K$60 represents the total number of new engines expected to be delivered over the period of the analysis and its cell formula is

[Cell 'Standard History'!$K$60 = SUM(Cell 'Standard History'!K14: Cell 'Standard History'!K58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

V. DESCRIPTION OF THE PAGE 3A 3B 4A 4B SHEET

A. INTRODUCTION

Pages 3a, 3b, 4a, and 4b of the model share a single worksheet in the workbook which is identified by the tab labeled '3a 3b 4a 4b'. These pages provide information regarding the current and proposed engine configurations.

Page 3a deals with scheduled and unscheduled maintenance events for the engine's current configuration. Page 3b calculates the costs pertaining to the maintenance events on page 3a. Page 4a details how the proposed change will effect maintenance events and costs for the engine being modified. Page 4b continues with further cost calculations on the proposed configuration.

The '3a 3b 4a 4b' sheet contains additional calculations to the right of page 4b in the blue area of the spreadsheet. These "blue" equations are contained in eleven columns which deal primarily with calculating the number of field upgrades to perform.

This chapter provides a description of each page of the worksheet, the columns in the worksheet, and the formulas and variables used to make calculations.

B. DESCRIPTION OF PAGE 3A

The computations on this page of the model deal with maintenance events pertaining to the current engine configuration being modified. Page 3a contains eighteen columns of which only five compute or display data. The empty columns between computational columns allow the user to directly compare the current configuration data to the proposed configuration data on page 4a.

1. Calendar Year (Column B)

Column B displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model. The reference in cell '3a 3b 4a 4b'!$B$14, labeled CurYr, is

[Cell '3a 3b 4a 4b'!$B$14 = Cell 'Standard History'!B14].

Cell 'Standard History'!$B$14 is labeled FirstYrStdHistory and represents the first year of the analysis. It is entered by the user in cell 32 of the applicable fleet in the Std_hist.xls file.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

2. Avg. No. Engines - Current Engines (Column D)

Column D calculates the average number of unmodified engines in service for each year of the analysis. This is accomplished by taking an average of the cumulative number of unmodified engines in service at the end of the current year and the cumulative number of unmodified engines in service at the end of the previous year. The formula in cell '3a 3b 4a 4b'!$D$14, labeled CurAvgUnmodEng, is

[Cell '3a 3b 4a 4b'!$D$14 = (Cell 'Standard History'!F14 + Cell 'Standard History'!F13)/2].

Cell 'Standard History'!$F$14 is labeled CurYrEngDelCum and represents the cumulative number of engines in the fleet during the current year.

Cell 'Standard History'!$F$13 is labeled PrevYrEngDelCum and represents the cumulative number of engines in the fleet during the previous year. In this case, it equals zero and is only used as place holder to begin column F calculations.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

3. Yearly Engine Flight Hours - Current EFH (1000 EFH) (Column F)

Column F calculates the expected annual engine flight hours for the current engine configuration in thousands of hours. This is done by dividing annual expected engine flight hours by 1000. The formula for cell '3a 3b 4a 4b'!$F$14, labeled CurYrCurUnmodEfh, is

[Cell '3a 3b 4a 4b'!$F$14 = Cell 'Standard History'!G14 / 1000].

Cell 'Standard History'!$G$14 is labeled AnnualFleetEfh and represents the average total whole number of engine hours flown in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$F$60 totals the expected number of current configuration engine flight hours flown over the period of the analysis in thousands of hours. The formula in this cell is

[Cell '3a 3b 4a 4b'!$F$60 = SUM(Cell '3a 3b 4a 4b'!F14: Cell '3a 3b 4a 4b'!F58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

4. Unsch. Events - Current (Column H)

Column H calculates the expected number of unscheduled maintenance events generated annually for the current engine configuration. This computation is accomplished by multiplying the current configuration unscheduled event rate by the current year's annual flight hours. The formula for cell '3a 3b 4a 4b'!$H$14, labeled CurUnschEvtUnmod, is

[Cell '3a 3b 4a 4b'!$H$14 = Cell 'Input'!E$48 * CurYrCurUnmodEfh].

This equals

[Cell '3a 3b 4a 4b'!$H$14 = Cell 'Input'!E$48 * Cell '3a 3b 4a 4b'!F14].

Cell 'Input'!$E$48 is labeled CurUnschEvtRate and represents the rate at which the component is expected to fail per 1000 engine flight hours.

CurYrCurUnmodEfh is cell '3a 3b 4a 4b'!$F$14 and represents the current year's expected number of engine flight hours for unmodified engines in thousands of hours.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$H$60 is the total number of unscheduled maintenance events generated for unmodified engines over the period of the analysis. The formula for this cell is

[Cell '3a 3b 4a 4b'!$H$60 = SUM(Cell '3a 3b 4a 4b'!H14: Cell '3a 3b 4a 4b'!H58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

5. Sched. Events - Current (Column J)

Column J calculates the expected number of scheduled maintenance events generated annually by the current configuration. The cell formula in cell '3a 3b 4a 4b'!$J$14, labeled CurSchEvtunmod, is

[Cell '3a 3b 4a 4b'!$J$14 = SchAvailFlag * Cell 'Input'!$E$33 * CurYrCurUnmodEfh].

This equals

[Cell '3a 3b 4a 4b'!$J$14 = Cell '3a 3b 4a 4b'!BZ14 * Cell 'Input'!$E$33 * Cell '3a 3b 4a 4b'!F14].

SchAvailFlag is cell '3a 3b 4a 4b'!$BZ$14 and produces a flag to determine if scheduled maintenance inspections may occur.

Cell 'Input'!$E$33 is labeled CurCalSchMaintInt and represents the calculated scheduled maintenance interval rate per 1000 engine flight hours.

CurYrCurUnmodEfh is cell '3a 3b 4a 4b'!$F$14 and represents the current year's expected number of engine flight hours for unmodified engines in thousands of hours.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$J$60 sums the expected number of scheduled maintenance events generated annually by the current configuration. The cell formula for this cell is

[Cell '3a 3b 4a 4b'!$J$60 = SUM(Cell '3a 3b 4a 4b'!J14: Cell '3a 3b 4a 4b'!J58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

C. DESCRIPTION OF PAGE 3B

The computations on this page of the model deal with current configuration cost information related to the maintenance events calculated on page 3a. Page 3b contains eighteen columns of which only nine compute or display data. The empty columns between computational columns allow the user to directly compare the current configuration data to the proposed configuration data on page 4b. Cost figures on the page are given in thousands of dollars.

1. Calendar Year (Column U)

Column U displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model. The reference in cell '3a 3b 4a 4b'!$B$14, labeled CurYr1, is
[Cell '3a 3b 4a 4b'!$U$14 = Cell 'Standard History'!B14].

Cell 'Standard History'!$B$14 is labeled FirstYrStdHistory and represents the first year of the analysis. FirstYrStdHistory is entered by the user in cell 32 of the applicable fleet in the Std_hist.xls file.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

2. Part Maint Cost - Current (Column X)

Column X calculates the expected annual cost of maintaining the parts required to support the component being modified in the current engine configuration. The result is displayed in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$X$14, labeled CurPNMaintCostUnmod, is

[Cell '3a 3b 4a 4b'!$X$14 = IF(CurAvgUnmodEng > 0, Cell 'Input'!E$64 * Cell 'Input'!G$15 / 1000, 0].

This equals

[Cell '3a 3b 4a 4b'!$X$14 = IF(Cell '3a 3b 4a 4b'!D14 > 0, Cell 'Input'!E$64 * Cell 'Input'!G$15 / 1000, 0].

CurAvgUnmodEng is cell '3a 3b 4a 4b'!$D$14 and represents the average number of unmodified engines in service in the current year.

Cell 'Input'!$E$64 is labeled CurPartNums and represents the number of parts to be removed from the system under the current configuration.

Cell 'Input'!$G$15 is labeled PnMatinCost and represents the annual cost of supporting a single part.

The IF statement uses the following logic to determine the annual part number maintenance cost for the current engine configuration.

A) If the average number of engines during the current year is greater than zero, then the part number maintenance cost for the current year is the product of the number of part numbers in the current engine configuration component being modified and the annual cost of maintaining each part number. This quantity is then divided by 1000.

B) If the average number of engines during the current year is less than or equal to zero, then the part number maintenance cost for the current year is zero.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$X$60 is the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis. The formula in this cell is

[Cell '3a 3b 4a 4b'!$X$60 = SUM(Cell '3a 3b 4a 4b'!X14: Cell '3a 3b 4a 4b'!X58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

3. Current Unsch Cost - Labor (Column Z)

Column Z calculates the expected annual cost of labor generated by unscheduled maintenance events for engines with the current configuration. The result is displayed in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$Z$14 is

[Cell '3a 3b 4a 4b'!$Z$14 = (Cell 'Interim'!D$40 + Cell 'Interim'! D$41) * CurUnschEvtUnmod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$Z$14 = (Cell 'Interim'!D$40 + Cell 'Interim'! D$41) * Cell '3a 3b 4a 4b'!H14 / 1000].

Cell 'Interim'!$D$40 is labeled CurUnschOILaborCost_Evt and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels.

CurUnschDepLaborCost_Evt is cell 'Interim'!$D$41 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Depot level.

CurUnschEvtUnmod is cell '3a 3b 4a 4b'!$H$14 represents the number of unscheduled maintenance events generated during the current year with the current engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$Z$60 is the total expected cost of labor generated by unscheduled maintenance events for engines with the current configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$Z$60 = SUM(Cell '3a 3b 4a 4b'!Z14: Cell '3a 3b 4a 4b'!Z58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$Z$63 calculates the expected labor cost, in thousands of dollars, per unscheduled maintenance event for the current engine configuration. The cell formula is

[Cell '3a 3b 4a 4b'!$Z$63 = Cell 'Interim'!$D$42 / 1000].

CurUnschTotLaborCost_Evt is cell 'Interim'!$D$42 and represents the total expected cost of labor for maintenance on the current engine configuration generated by unscheduled maintenance events.

4. Current Unsch Cost - Material (Column AA)

Column AA calculates the expected annual cost of materials generated by unscheduled maintenance events for engines with the current configuration. The result is displayed in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$AA$14, labeled CurUnmodUnschLabCost is

[Cell '3a 3b 4a 4b'!$AA$14 = (Cell 'Interim'!D$44 + Cell 'Interim'!D$45 + Cell 'Interim'!D$46 + Cell 'Interim'!D$49 + Cell 'Interim'!D$52) * CurUnschEvtUnmod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$AA$14 = (Cell 'Interim'!D$44 + Cell 'Interim'!D$45 + Cell 'Interim'!D$46 + Cell 'Interim'!D$49 + Cell 'Interim'!D$52) * Cell '3a 3b 4a 4b'!H14 / 1000].

Cell 'Interim'!$D$44 is labeled CurUnschOIRepCost_Evt and represents the expected cost of materials during unscheduled maintenance on the current engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$D$45 is labeled CurUnschDepRepCost_Evt and represents the expected cost of unscheduled maintenance on the current engine configuration at the Depot level.

Cell 'Interim'!$D$46 is labeled CurUnschScrapCost_Evt and represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the current engine configuration.

CurUnschTestLabFuelCost_Evt is cell 'Interim'!$D$49 and represents the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

Cell 'Interim'!$D$52 represents the cost of damage to other engine parts or components caused by failure of the component being modified and expected incidental costs for each unscheduled maintenance event not covered by any other input element. Cell 'Interim'!$D$52 is also described using the variable name CurUnschSecIncidentalDamCost_Evt.

CurUnschEvtUnmod is cell '3a 3b 4a 4b'!$H$14 and represents the number of unscheduled maintenance events generated during the current year for the current engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AA$60 is the total expected cost of materials generated by unscheduled maintenance events for engines with the current configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$AA$60 = SUM(Cell '3a 3b 4a 4b'!AA14:
Cell '3a 3b 4a 4b'!AA58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AA$63 calculates, in thousands of dollars, the total expected material cost per unscheduled maintenance event for the current engine configuration. The cell formula is

[Cell '3a 3b 4a 4b'!$AA$63 = Cell 'Interim'!$D$53 / 1000].

Cell 'Interim'!$D$53 is labeled CurTotMatCostUnschEvt and represents the total expected material cost per unscheduled maintenance event for the current engine configuration.

5. Current Sched Cost - Labor (Column AB)

Column AB calculates the expected annual cost of labor generated by scheduled maintenance events for engines with the current configuration. The result is displayed in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$AB$14 is

[Cell '3a 3b 4a 4b'!$AB$14 = (Cell 'Interim'!D$26 + Cell 'Interim'!D$27) * CurSchEvtunmod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$AB$14 = (Cell 'Interim'!D$26 + Cell 'Interim'!D$27) * Cell '3a 3b 4a 4b'!$J$14 / 1000].

Cell 'Interim'!$D$26 is labeled CurSchOILaborCost_Evt and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$D$27 is labeled CurSchDepLaborCost_Evt and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Depot level.

CurSchEvtunmod is cell '3a 3b 4a 4b'!$J$14 and represents the number of scheduled maintenance events generated in the current year by the current engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AB$60 is the total expected cost of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$AB$60 = SUM(Cell '3a 3b 4a 4b'!AB14:
Cell '3a 3b 4a 4b'!AB58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AB$63 calculates the expected labor cost, in thousands of dollars, per scheduled maintenance event for the current engine configuration. The cell formula is

[Cell '3a 3b 4a 4b'!$AB$63 = Cell 'Interim'!$D$28 / 1000].

Cell 'Interim'!$D$28 is labeled CurSchTotLaborCost_Evt and represents the total expected cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events.

6. Current Sched Cost - Material (Column AC)

Column AC calculates the expected annual cost of materials generated by scheduled maintenance events for engines with the current configuration. The result is displayed in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$AC$14, labeled CurUnmodSchMatCost is

[Cell '3a 3b 4a 4b'!$AC$14 = (Cell 'Interim'!D$30 + Cell
'Interim'!D$31 + Cell 'Interim'!D$32 + Cell 'Interim'!D$35)
* CurSchEvtunmod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$AC$14 = (Cell 'Interim'!D$30 + Cell
'Interim'!D$31 + Cell 'Interim'!D$32 + Cell 'Interim'!D$35)
* Cell '3a 3b 4a 4b'!J14 / 1000].

Cell 'Interim'!$D$30 is labeled CurSchOIRepCost_Evt and represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$D$31 is labeled CurSchDepRepCost_Evt and represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Depot level.

Cell 'Interim'!$D$32 is labeled CurSchScrapCost_Evt and represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the current engine configuration.

CurSchTestLabFuelCost_Evt is cell 'Interim'!$D$35 and represents the expected cost of labor and fuel used to test the current engine configuration after scheduled maintenance at the Organizational and Intermediate levels.

CurSchEvtunmod is cell '3a 3b 4a 4b'!$J$14 and represents the number of scheduled maintenance events generated in the current year by the current engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AC$60 is the total expected cost of materials generated by scheduled maintenance events for the current engine configuration over the period of the analysis in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$AC$60 = SUM(Cell '3a 3b 4a 4b'!AC14:
Cell '3a 3b 4a 4b'!AC58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AC$63 calculates the total expected cost of materials, in thousands of dollars, per scheduled maintenance event for the current engine configuration. The cell formula is

[Cell '3a 3b 4a 4b'!$AC$63 = Cell 'Interim'!$D$36 / 1000].

Cell 'Interim'!$D$36 is labeled CurTotMatCostSch and represents the total expected cost of materials per scheduled maintenance event on the current engine configuration.

7. Current Total Cost (Column AH)

Column AH calculates, in thousands of dollars, the expected annual logistics support costs for the current engine configuration, not including operational fuel. The formula in cell '3a 3b 4a 4b'!$AH$14, labeled CurTotCost, is

[Cell '3a 3b 4a 4b'!$AH$14 = SUM(Cell '3a 3b 4a 4b'!X14:
Cell '3a 3b 4a 4b'!AC14)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AH$60 calculates the total expected logistics support costs over the period of the analysis. Its cell formula is

[Cell '3a 3b 4a 4b'!$AH$60 = SUM(Cell '3a 3b 4a 4b'!AH14:
Cell '3a 3b 4a 4b'!AH58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

8. Operational Fuel - Gal/Yr (Column AI)

Column AI calculates the expected annual number of gallons of fuel that will be consumed operationally by engines with the current configuration. The result is displayed in thousands of gallons per year. The formula in cell ‘3a 3b 4a 4b’!$AI$14, labeled CurOperFuelGalYr, is

[Cell ‘3a 3b 4a 4b’!$AI$14 = IF(Cell ‘Input’!$F$66 <> 0, CurYrCurUnmodEfh * Cell ‘Standard History’!$G$63, “N/A”)].

This equals

[Cell ‘3a 3b 4a 4b’!$AI$14 = IF(Cell ‘Input’!$F$66 <> 0, Cell ‘3a 3b 4a 4b’!F14 * Cell ‘Standard History’!$G$63, “N/A”)].

Cell ‘Input’!$F$66 is labeled PctImpSFC and represents the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration.

CurYrCurUnmodEfh is cell ‘3a 3b 4a 4b’!$F$14 and represents the expected number of engine flight hours for the current engine configuration, in thousands of hours, for the current year.

Cell ‘Standard History’!$G$63 is labeled FltFuelGH and represents the expected specific fuel consumption rate of the current engine configuration in gallons per hour.

The IF statement uses the following logic to determine the expected annual number of gallons of fuel that will be consumed operationally by engines with the current configuration:

A) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does not equal zero, then the value displayed is the product of the current engine configuration's expected number of engine flight hours and its expected specific fuel consumption rate.

B) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does equal zero, then "N/A" is displayed since there will be no change in fuel consumption with the proposed engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AI$60 calculates the total expected number of gallons of fuel that will be consumed operationally by engines with the current configuration. over the period of the analysis. The cell formula is

```
[Cell '3a 3b 4a 4b'!$AI$60 = SUM(Cell '3a 3b 4a 4b'!AI14:
Cell '3a 3b 4a 4b'!AI58)].
```

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

9. Operational Fuel - Cost (Column AJ)

Column AJ calculates the expected annual operational fuel costs, in thousands of dollars, for engines with the current configuration. The formula in cell '3a 3b 4a 4b'!$AJ$14, labeled CurOperFuelCost, is

```
[Cell '3a 3b 4a 4b'!$AJ$14 = IF(Cell 'Input'!$F$66 <> 0,
CurOperFuelGalYr * Cell 'Input'!$G$17, "N/A")].
```

This equals

[Cell '3a 3b 4a 4b'!$AJ$14 = IF(Cell 'Input'!$F$66 <> 0, Cell '3a 3b 4a 4b'!AI14 * Cell 'Input'!$G$17, "N/A")].

Cell 'Input'!$F$66 is labeled PctImpSFC and represents the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration.

CurOperFuelGalYr is cell '3a 3b 4a 4b'!AI14 and represents the expected number of gallons of fuel, in thousands of gallons, that will be consumed operationally by the current engine configuration during the current year.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon.

The IF statement uses the following logic to determine the expected annual operational fuel costs, in thousands of dollars, for the current engine configuration:

A) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does not equal zero, then the value displayed is the product of the expected number of gallons of fuel, in thousands of gallons, that will be consumed operationally by current engine configuration during the current year and the cost of fuel per gallon.

B) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does equal zero, then "N/A" is displayed since there will be no change in fuel consumption with the proposed engine configuration.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AJ$60 calculates the total expected operational fuel costs, in thousands of dollars, for current engine configuration over the period of the analysis. Its cell formula is

[Cell '3a 3b 4a 4b'!$AJ$60 = SUM(Cell '3a 3b 4a 4b'!AJ14:
Cell '3a 3b 4a 4b'!AJ58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

10. Total Cost Curr Config w/ Fuel (Column AL)

Column AL calculates, in thousands of dollars, the expected annual logistics support costs, including operational fuel, for the current engine configuration. The formula in cell '3a 3b 4a 4b'!$AL$14, labeled CurTotCst, is

[Cell '3a 3b 4a 4b'!$AL$14 = CurTotCost + CurOperFuelCost].

This equals

[Cell '3a 3b 4a 4b'!$AL$14 = Cell '3a 3b 4a 4b'!AH14 + Cell
'3a 3b 4a 4b'!AJ14].

CurTotCost is cell '3a 3b 4a 4b'!$AH$14 and represents the expected annual logistics support costs, in thousands of dollars, for the current engine configuration, not including operational fuel for the current year.

CurOperFuelCost is cell '3a 3b 4a 4b'!$AJ$14 and represents the expected operational fuel costs, in thousands of dollars, for current engine configuration during the current year.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AL$60 calculates the total expected logistics support costs, in thousands of dollars, for the current engine configuration over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AL$60 = SUM(Cell '3a 3b 4a 4b'!AL14:
Cell '3a 3b 4a 4b'!AL58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

D. DESCRIPTION OF PAGE 4A

Page 4a of the model deals with maintenance events pertaining to the proposed engine configuration, aircraft saved, number of kits installed and the costs associated with kit installation. Page 4a contains eighteen columns, all of which are used in describing how the proposed change will effect the number of maintenance events, and eventually costs, of the engine.

1. Calendar Year (Column AN)

Column AN displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model. The reference in cell '3a 3b 4a 4b'!$AN$14, labeled CurYr2, is

[Cell '3a 3b 4a 4b'!$AN$14 = Cell 'Standard History'!B14].

FirstYrStdHistory is cell 'Standard History'!$B$14 and represents the first year of the analysis. FirstYrStdHistory is entered by the user in cell 32 of the applicable fleet in the Std_hist.xls file.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

2. Engines Mod in Prod (Column AO)

Column AO calculates the expected number of engines modified during production each year. The formula in cell '3a 3b 4a 4b'!$AO$14, labeled ProEngModProd, is

[Cell '3a 3b 4a 4b'!$AO$14 = IF(Cell 'Standard History'!E14 > 0, Cell 'Standard History'!E14 * Cell 'Standard History'!C14 / 12, 0)].

Cell 'Standard History'!$E$14 is labeled CurYrEngDel and represents the number of new engines delivered to the fleet during the current year.

Cell 'Standard History'!$C$14 is labeled MoAvailProd and represents the number of months during the current year that the modification is expected to be incorporated into production engines.

The IF statement uses the following logic to determine the number of engines modified during production each year.

A) If the number of new engines delivered to the fleet during the current year is greater than zero, then the number of engines modified during production in the current year is the product of the number of new engines delivered to the fleet during the current year and the number of months during the current year that the modification is expected to be incorporated into production engines divided by twelve.

B) If the number of new engines delivered to the fleet during the current year is less than or equal to zero, then the number of engines modified during production in the current year is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AO$60 is labeled TotEngModProd and represents the total number of engines modified during production over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AO$60 = SUM(Cell '3a 3b 4a 4b'!AO14: Cell '3a 3b 4a 4b'!AO58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

3. Avg. No. Engines - UnMod Engines (Column AP)

Column AP calculates the average number unmodified engines in the fleet for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$AP$14, labeled ProAvgUnmodEng, is

[Cell '3a 3b 4a 4b'!$AP$14 = IF(TotKitIncorpRate > CritIncorpRate, FlyEngPotenForModEo /(TotKitIncorpRate / 1000 * Cell 'Standard History'!H14), (FlyEngPotenForModEo + FlyEngNotModEn) / 2)].

This equals

[Cell '3a 3b 4a 4b'!$AP$14 = IF(Cell '3a 3b 4a 4b'!CH14 > Cell '3a 3b 4a 4b'!CD14, Cell '3a 3b 4a 4b'!CB14 /(Cell '3a 3b 4a 4b'!CH14 / 1000 * Cell 'Standard History'!H14), (Cell '3a 3b 4a 4b'!CB14 + Cell '3a 3b 4a 4b'!CC14) / 2)].

TotKitIncorpRate is cell '3a 3b 4a 4b'!$CH$14 and represents the engine modification incorporation rate in events per 1000 engine flight hours.

CritIncorpRate is cell '3a 3b 4a 4b'!$CD$14 and represents the incorporation rate necessary to modify all engines available for modification for the current year.

FlyEngPotenForModEo is cell '3a 3b 4a 4b'!$CB$14 and represents the average number of flying engines that could be modified in the current year.

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine during the current year.

FlyEngNotModEn is cell '3a 3b 4a 4b'!$CC$14 and represents the average number of engines flying the next year of the analysis if no deliveries, phase-outs or modifications occur.

The IF statement uses the following logic to determine the average number unmodified engines in the fleet for each year of the analysis.

A) If the engine modification incorporation rate, in events per 1000 engine flight hours, is greater than the incorporation rate necessary to modify all engines available for modification for the current year, then the number displayed is the average number of flying engines that could be modified in the current year divided by the product of the engine modification incorporation rate in events per 1000 engine flight hours divided by 1000 and the average annual flight hours flown by each engine during the current year.

B) If the engine modification incorporation rate, in events per 1000 engine flight hours, is less than or equal to the incorporation rate necessary to modify all engines available for modification for the current year, then the number displayed is the sum of the average number of flying engines that could be modified in the current year and the average number of engines flying the next year of the analysis if no deliveries, phase-outs or modifications occur divided by two.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

4. Avg. No. Engines - Mod Engines (Column AQ)

Column AQ calculates the average number of engines expected to be modified for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$AQ$14, labeled ProAvgModEng, is

[Cell '3a 3b 4a 4b'!$AQ$14 = CurAvgUnmodEng - ProAvgUnmodEng].

This equals

[Cell '3a 3b 4a 4b'!$AQ$14 = Cell '3a 3b 4a 4b'!D14 - Cell '3a 3b 4a 4b'!AP14].

CurAvgUnmodEng is cell '3a 3b 4a 4b'!$D$14 and represents the average number of unmodified engines in service during the current year.

ProAvgUnmodEng is cell '3a 3b 4a 4b'!$AP$14 and represents the average number unmodified engines in the fleet for the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

5. Yearly Engine Flight Hours - Unmod EFH (EFH/1000) (Column AR)

Column AR calculates the expected number of engine flight hours, in thousands of hours, logged by unmodified engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$AR$14, labeled CurYrProUnmodEfh, is

[Cell '3a 3b 4a 4b'!$AR$14 = ProAvgUnmodEng * Cell 'Standard History'!H14 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$AR$14 = Cell '3a 3b 4a 4b'!AP14 * Cell 'Standard History'!H14 / 1000].

ProAvgUnmodEng is cell '3a 3b 4a 4b'!$AP$14 and represents the average number of unmodified engines in the fleet for the current year of the analysis.

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine during the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AR$60 calculates the total expected number of engine flight hours, in thousands of hours, logged by unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AR$60 = SUM(Cell '3a 3b 4a 4b'!AR14: Cell '3a 3b 4a 4b'!AR58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

6. Yearly Engine Flight Hours - Mod EFH (EFH/1000) (Column AS)

Column AS calculates the expected number of engine flight hours, in thousands of hours, logged by modified engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$AS$14, labeled CurYrProModEfh, is

[Cell '3a 3b 4a 4b'!$AS$14 = ProAvgModEng * Cell 'Standard History'!H14 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$AS$14 = Cell '3a 3b 4a 4b'!AQ14 * Cell 'Standard History'!H14 / 1000].

ProAvgModEng is cell '3a 3b 4a 4b'!$AQ$14 and represents the average number of engines expected to be modified in the current year.

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine during the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AS$60 calculates the total expected number of engine flight hours, in thousands of hours, logged by modified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AS$60 = SUM(Cell '3a 3b 4a 4b'!AS14: Cell '3a 3b 4a 4b'!AS58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AS$61 calculates the total expected number of engine flight hours, in thousands of hours, logged by modified and unmodified engines combined over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AS$61 = Cell '3a 3b 4a 4b'!AR60 + Cell '3a 3b 4a 4b'!AS60].

Cell '3a 3b 4a 4b'!$AR$60 represents the total expected number of engine flight hours, in thousands of hours, logged by unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$AS$60 represents the total expected number of engine flight hours, in thousands of hours, logged by modified engines over the period of the analysis.

7. Unsched. Events - Unmod (Column AT)

Column AT calculates the expected number of unscheduled maintenance events generated by the component being modified on unmodified engines. The formula in cell '3a 3b 4a 4b'!$AT$14, labeled ProUnschEvtUnmod, is

[Cell '3a 3b 4a 4b'!$AT$14 = Cell 'Input'!$E$48 * CurYrProUnmodEfh].

This equals

[Cell '3a 3b 4a 4b'!$AT$14 = Cell 'Input'!$E$48 * Cell '3a 3b 4a 4b'!AR14].

Cell 'Input'!$E$48 is labeled CurUnschEvtRate and represents the rate at which the component being modified, on the current engine configuration, is expected to fail per 1000 engine flight hours.

CurYrProUnmodEfh is cell '3a 3b 4a 4b'!$AR$14 and represents the expected number of engine flight hours logged by unmodified engines during the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AT$60 calculates the total expected number of unscheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AT$60 = SUM(Cell '3a 3b 4a 4b'!AT14: Cell '3a 3b 4a 4b'!AT58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

8. Unsched. Events - Mod (Column AU)

Column AU calculates the expected number of unscheduled maintenance events generated by the component being modified on modified engines. The formula in cell '3a 3b 4a 4b'!$AU$14, labeled ProUnschEvtMod, is

[Cell '3a 3b 4a 4b'!$AU$14 = Cell 'Input'!$F$48 * CurYrProModEfh].

This equals

[Cell '3a 3b 4a 4b'!$AU$14 = Cell 'Input'!$F$48 * Cell '3a 3b 4a 4b'!AS14].

Cell 'Input'!$F$48 is labeled ProUnschEvtRate and represents the rate at which the component being modified, on the proposed engine configuration, is expected to fail per 1000 engine flight hours.

CurYrProModEfh is cell '3a 3b 4a 4b'!$AS$14 and represents the expected number of engine flight hours, in thousands of hours, logged by modified engines in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AU$60 calculates the total expected number of unscheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AU$60 = SUM(Cell '3a 3b 4a 4b'!AU14:
Cell '3a 3b 4a 4b'!AU58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AU$61 calculates the total expected number of unscheduled maintenance events generated by the component being modified on both modified and unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AU$61 = Cell '3a 3b 4a 4b'!AT60 + Cell
'3a 3b 4a 4b'!AU60].

Cell '3a 3b 4a 4b'!$AT$60 represents the total expected number of unscheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$AU$60 represents the total expected number of unscheduled maintenance events generated by the component being modified on modified engines over the period of the analysis.

9. Sched. Events - Unmod (Column AV)

Column AV calculates the expected number of scheduled maintenance events generated by the component being modified on unmodified engines. The formula in cell '3a 3b 4a 4b'!$AV$14, labeled ProSchEvtUnmod, is

[Cell '3a 3b 4a 4b'!$AV$14 = SchAvailFlag * Cell 'Input'!$E$33 * CurYrProUnmodEfh].

This equals

[Cell '3a 3b 4a 4b'!$AV$14 = Cell '3a 3b 4a 4b'!BZ14 * Cell 'Input'!$E$33 * Cell '3a 3b 4a 4b'!AR14].

SchAvailFlag is cell '3a 3b 4a 4b'!$BZ$14 and produces a flag to determine if scheduled maintenance inspections may occur.

Cell 'Input'!$E$33 is labeled CurCalSchMaintInt and represents the calculated scheduled maintenance interval rate per 1000 engine flight hours for the current engine configuration.

CurYrProUnmodEfh is cell '3a 3b 4a 4b'!$AR$14 and represents the expected number of engine flight hours logged by unmodified engines during the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AV$60 calculates the total expected number of scheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AV$60 = SUM(Cell '3a 3b 4a 4b'!AV14: Cell '3a 3b 4a 4b'!AV58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

10. Sched. Events - Mod (Column AW)

Column AW calculates the expected number of scheduled maintenance events generated by the component being modified on modified engines. The formula in cell '3a 3b 4a 4b'!$AW$14, labeled ProSchEvtMod, is

[Cell '3a 3b 4a 4b'!$AW$14 = SchAvailFlag * Cell 'Input'!$F$33 * CurYrProModEfh].

This equals

[Cell '3a 3b 4a 4b'!$AW$14 = Cell '3a 3b 4a 4b'!$BZ$14 * Cell 'Input'!$F$33 * Cell '3a 3b 4a 4b'!AS14].

SchAvailFlag is cell '3a 3b 4a 4b'!$BZ$14 and produces a flag to determine if scheduled maintenance inspections may occur.

Cell 'Input'!$F$33 is labeled ProCalSchMaintInt and represents the calculated scheduled maintenance interval rate per 1000 engine flight hours for the proposed engine configuration.

CurYrProModEfh is cell '3a 3b 4a 4b'!$AS$14 and represents the expected number of engine flight hours, in thousands of hours, logged by modified engines for the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AW$60 calculates the total expected number of scheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AW$60 = SUM(Cell '3a 3b 4a 4b'!AW14: Cell '3a 3b 4a 4b'!AW58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$AW$61 calculates the total expected number of scheduled maintenance events generated by the component being modified on modified and unmodified engines combined over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AW$61 = Cell '3a 3b 4a 4b'!AV60 + Cell '3a 3b 4a 4b'!AW60].

Cell '3a 3b 4a 4b'!$AV$60 represents the total expected number of scheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$AW$60 represents the total expected number of scheduled maintenance events generated by the component being modified on modified engines over the period of the analysis.

11. A/C Loss Events - Cum (Column AX)

Column AX calculates the cumulative expected number of aircraft (A/C), with the proposed engine configuration, lost during each year of the analysis. A loss, in this case, is defined as the destruction of an aircraft caused by a failure of the component being modified. The formula in cell '3a 3b 4a 4b'!$AX$14, labeled CurYrProACLEvtCum, is

[Cell '3a 3b 4a 4b'!$AX$14 = (CurYrProModEfh * Cell 'Input'!$F$67) / 1000 + PrevYrProACLEvtCum].

This equals

[Cell '3a 3b 4a 4b'!$AX$14 = (Cell '3a 3b 4a 4b'!AS14 * Cell 'Input'!$F$67) / 1000 + Cell '3a 3b 4a 4b'!AX13].

CurYrProModEfh is cell '3a 3b 4a 4b'!$AS$14 and represents the expected number of engine flight hours, in thousands of hours, logged by modified engines for the current year.

Cell 'Input'!$F$67 is labeled AClossImprove and represents the improvement in the number of Class A mishaps, per one million EFH, with the proposed engine configuration.

PrevYrProACLEvtCum is cell '3a 3b 4a 4b'!$AX$13 and is used as a place holder to begin the column AX calculations.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

12. A/C Loss Events - Annual (Column AY)

Column AY calculates the number of aircraft (A/C), with the proposed engine configuration, expected to be lost during the current year. A loss, in this case, is defined as the destruction of an aircraft caused by a failure of the component being modified. The formula in cell '3a 3b 4a 4b'!$AY$14, labeled ProACLossPerYr, is

[Cell '3a 3b 4a 4b'!$AY$14 = TRUNC(CurYrProACLEvtCum)].

This equals

[Cell '3a 3b 4a 4b'!$AY$14 = TRUNC(Cell '3a 3b 4a 4b' !AX14)].

CurYrProACLEvtCum is cell '3a 3b 4a 4b'!$AX$14 and represents the cumulative expected number of aircraft, with the proposed engine configuration, lost through the first year of the analysis.

TRUNC is an EXCEL worksheet function which truncates a number to an integer by removing the fractional part of the number.

The cell formula for the next year is

[Cell '3a 3b 4a 4b'!$AY$15 = IF(TRUNC(Cell '3a 3b 4a 4b'!AX15) <> TRUNC(CurYrProACLEvtCum), TRUNC(Cell '3a 3b 4a 4b'!AX15) - TRUNC(CurYrProACLEvtCum), 0)].

This equals

[Cell '3a 3b 4a 4b'!$AY$15 = IF(TRUNC(Cell '3a 3b 4a 4b'!AX15) <> TRUNC(Cell '3a 3b 4a 4b'!AX14), TRUNC(Cell '3a 3b 4a 4b'!AX15) - TRUNC(Cell '3a 3b 4a 4b'!AX14), 0)].

The IF statement uses the following logic to determine expected number of aircraft, with the proposed engine configuration, lost during the current year.

A) If the truncated, cumulative number of aircraft expected to be lost by the end of the current year does not equal the truncated, cumulative number of aircraft expected to be lost by the end of the year prior, then the value displayed is the truncated, cumulative number of aircraft expected to be lost by the end of the current year minus the truncated, cumulative number of aircraft expected to be lost by the end of the prior year.

B) If the truncated, cumulative number of aircraft expected to be lost by the end of the current year does equal the truncated, cumulative number of aircraft expected to be lost by the end of the year prior, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AY$60 calculates the total number of aircraft, with the proposed engine configuration, expected to be lost over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AY$60 = SUM(Cell '3a 3b 4a 4b'!AY14:
Cell '3a 3b 4a 4b'!AY58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

13. Engine Kits - Ed No. Installed (Column AZ)

Column AZ calculates the expected (Ed) number of engines to be modified in the current year. The cell formula for cell '3a 3b 4a 4b'!$AZ$14, labeled CurYrProEngKitInstal, is

[Cell '3a 3b 4a 4b'!$AZ$14 = IF(Cell 'Input'!$D$9 = 3, MIN
(Cell 'Input'!$D$12 * 12 * Cell 'Standard History'!D14 / 12,
FlyEngPotenForModEo), IF(TotKitIncorpRate > CritIncorpRate,
FlyEngPotenForModEo, FlyEngPotenForModEo * Cell 'Standard
History' !H14 * TotKitIncorpRate / 1000 / (1 + Cell
'Standard History'!H14 * TotKitIncorpRate / 2000)))].

This equals

[Cell '3a 3b 4a 4b'!$AZ$14 = IF(Cell 'Input'!$D$9 = 3, MIN
(Cell 'Input'!$D$12 * 12 * Cell 'Standard History'!D14 / 12,

Cell '3a 3b 4a 4b'!CB14), IF(Cell '3a 3b 4a 4b'!CH14 > Cell '3a 3b 4a 4b'!CD14, Cell '3a 3b 4a 4b'!CB14, Cell '3a 3b 4a 4b'!CB14 * Cell 'Standard History' !H14 * Cell '3a 3b 4a 4b'!CH14 / 1000 / (1 + Cell 'Standard History'!H14 * Cell '3a 3b 4a 4b'!CH14 / 2000)))].

Cell 'Input'!$D$9 is labeled IncorpStyle and determines how the change is incorporated.

Cell 'Input'!$D$12 is labeled ForcedRetroRate and represents the rate, in kits per month, the change is incorporated into the engine when forced retrofit is chosen as the incorporation style.

MoAvailFieldMod is cell 'Standard History'!$D$14 and represents the number of months during the current year that the modification will be incorporated into engines in the field.

FlyEngPotenForModEo is cell '3a 3b 4a 4b'!$CB$14 and represents the average number of flying engines that could be modified in the current year.

TotKitIncorpRate is cell '3a 3b 4a 4b'!$CH$14 and represents the engine modification incorporation rate in events per 1000 engine flight hours.

CritIncorpRate is cell '3a 3b 4a 4b'!$CD$14 and represents the incorporation rate necessary to modify all engines available for modification for the current year.

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine for the current year of the analysis.

MIN is an EXCEL worksheet function that returns the minimum of a set of values contained in a specified field.

The IF statement uses the following logic to determine the expected number of engines to be modified in the current year.

A) If the incorporation style chosen is forced retrofit, then the value displayed is the minimum of the product of the forced retrofit rate, 12 and the number of months during the current year that the modification will be incorporated into engines in the field divided by 12 or the average number of flying engines that could be modified in the current year.

B) If the incorporation style chosen is something other than forced retrofit and the engine modification incorporation rate in events per 1000 engine flight hours is greater than the incorporation rate necessary to modify all engines available for modification for the current year, then the value displayed is the average number of flying engines that could be modified in the current year.

C) If the incorporation style chosen is something other than forced retrofit and the engine modification incorporation rate in events per 1000 engine flight hours is less than or equal to the incorporation rate necessary to modify all engines available for modification for the current year, then the value displayed is the product of the average number of flying engines that could be modified in the current year, the average annual flight hours flown by each engine for the current year and the engine modification incorporation rate in events per 1000 engine flight hours divided by 1000. This quantity is divided by one plus the product of the average annual flight hours flown by each engine for the current year of the analysis and the engine modification incorporation rate in events per 1000 engine flight hours divided by 2000.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$AZ$60 calculates the total expected number of engines to be modified over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$AZ$60 = SUM(Cell '3a 3b 4a 4b'!AZ14: Cell '3a 3b 4a 4b'!AZ58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

14. Engine Kits - Mat'l Cost (Column BA)

Column BA calculates the expected cost, in thousands of dollars, of the modification kits installed in operational engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$BA$14, labeled ProEngKitMatCost, is

[Cell '3a 3b 4a 4b'!$BA$14 = Cell 'Input'!D$16 * CurYrProEngKitInstal / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BA$14 = Cell 'Input'!D$16 * Cell '3a 3b 4a 4b'!AZ14 / 1000].

Cell 'Input'!D$16 is labeled KitCost and represents the material cost of the kit. If the change does not use a kit, KitCost is the cost of the upgraded parts.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BA$60 calculates the total expected cost, in thousands of dollars, of the modification kits required over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BA$60 = SUM(Cell '3a 3b 4a 4b'!BA14:
Cell '3a 3b 4a 4b'!BA58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

15. Engine Kits - Labor Cost (Column BB)

Column BB calculates the expected cost, in thousands of dollars, of the labor required to modify operational engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$BB$14, labeled ProEngKitLabCost, is

[Cell '3a 3b 4a 4b'!$BB$14 = IF(Cell 'Interim'!D$11 *
CurYrProEngKitInstal > 1, Cell 'Interim'!D$11 *
CurYrProEngKitInstal / 1000, 0)].

This equals

[Cell '3a 3b 4a 4b'!$BB$14 = IF(Cell 'Interim'!D$11 * Cell
'3a 3b 4a 4b'!AZ14 > 1, Cell 'Interim'!D$11 * Cell '3a 3b 4a
4b'!AZ14 / 1000, 0)].

Cell 'Interim'!$D$11 is KitLaborCost and represents the total expected cost of labor per engine modification.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The IF statement uses the following logic to determine the expected cost, in thousands of dollars, of the labor required to modify the operational engines for each year of the analysis:

A) If the product of the total expected cost of labor per engine modification and the expected number of engines to be modified in the current year is greater than one, then the value displayed is the product of the total expected cost of labor per engine modification and the expected number of engines to be modified in the current year divided by 1000.

B) If the product of the total expected cost of labor per engine modification and the expected number of engines to be modified in the current year is less than or equal to one, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BB$60 calculates the total expected cost, in thousands of dollars, of the labor required to modify the engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BB$60 = SUM(Cell '3a 3b 4a 4b'!BB14:
Cell '3a 3b 4a 4b'!BB58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BB$63 calculates the total expected number of kits installed in both spare and operational engines over the period of the analysis. The cell formula for cell '3a 3b 4a 4b'!$BB$63 is

[Cell '3a 3b 4a 4b'!$BB$63 = Cell '3a 3b 4a 4b'!AZ60 + Cell '3a 3b 4a 4b'!BC60].

Cell '3a 3b 4a 4b'!$AZ$60 is the total expected number of operational engines to be modified over the period of the analysis.

Cell '3a 3b 4a 4b'!$BC$60 is the total expected number of spare engines to be modified over the period of the analysis.

Cell '3a 3b 4a 4b'!$BB$64 calculates the total expected cost, in thousands of dollars, of the modification kits for both spare and operational engines over the period of the analysis. The cell formula for cell '3a 3b 4a 4b'!$BB$64 is [Cell '3a 3b 4a 4b'!$BB$64 = Cell '3a 3b 4a 4b'!BA60 + Cell '3a 3b 4a 4b'!BD60].

Cell '3a 3b 4a 4b'!$BA$60 is the total expected cost, in thousands of dollars, of the modification kits required over the period of the analysis for operational engines.

Cell '3a 3b 4a 4b'!$BD$60 is the total expected cost, in thousands of dollars, of the modification kits required over the period of the analysis for spare engines.

Cell '3a 3b 4a 4b'!$BB$65 calculates the total expected cost, in thousands of dollars, of the labor required to incorporate the modification in both spare and operational engines over the period of the analysis. The cell formula is [Cell '3a 3b 4a 4b'!$BB$65 = Cell '3a 3b 4a 4b'!BB60 + Cell '3a 3b 4a 4b'!BE60].

Cell '3a 3b 4a 4b'!$BB$60 is the total expected cost, in thousands of dollars, of the labor required to incorporate the modification in operational engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$BE$60 is the total expected cost, in thousands of dollars, of the labor required to incorporate the modification in spare engines over the period of the analysis.

16. Spare Kits - No. Installed (Column BC)

Column BC calculates the number of kits expected to be installed in spare engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$BC$14, labeled ProSpareKitInstalled, is

[Cell '3a 3b 4a 4b'!$BC$14 = Cell 'Input'!$D$22 * (CurYrProEngKitInstal + ProEngModProd)].

This equals

[Cell '3a 3b 4a 4b'!$BC$14 = Cell 'Input'!$D$22 * (Cell '3a 3b 4a 4b'!AZ14 + Cell '3a 3b 4a 4b'!AO14)].

Cell 'Input'!$D$22 is labeled SparePartFactor and represents the percentage, relative to the fleet size, that is used to generate kit costs for spare parts. The spares are not engine spares because they are usually modeled as part of the fleet.. The spares could be component and/or assembly spares.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

ProEngModProd is cell '3a 3b 4a 4b'!$AO$14 and represents the number of engines expected to be modified during production in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BC$60 calculates the total number of kits expected to be installed in spare engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BC$60 = SUM(Cell '3a 3b 4a 4b'!BC14:
Cell '3a 3b 4a 4b'!BC58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BC$64 calculates the expected material cost per kit in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BC$64 = Cell 'Interim'!D$10 / 1000].

Cell 'Interim'!D$10 is labeled Kit_Cost and represents the cost of the engine modification kit.

Cell '3a 3b 4a 4b'!$BC$65 calculates the expected labor cost to install each kit in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BC$65 = Cell 'Interim'!D$11 / 1000].

Cell 'Interim'!D$11 is labeled KitLaborCost and represents the total expected cost of labor per engine modification.

17. Spare Kits - Mat'l Cost (Column BD)

Column BD calculates the expected cost, in thousands of dollars, of the modification kits installed in spare engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$BD$14, labeled ProSpareKitMatCost, is

[Cell '3a 3b 4a 4b'!$BD$14 = Cell 'Input'!D$16 * ProSpareKitInstalled / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BD$14 = Cell 'Input'!D$16 * Cell '3a 3b 4a 4b'!BC14 / 1000].

Cell 'Input'!$D$16 is labeled KitCost and represents the material cost of the kit. If the change does not use a kit, KitCost is the cost of the upgraded parts.

ProSpareKitInstalled is cell '3a 3b 4a 4b'!$BC$14 and represents the number of kits expected to be installed in spare engines for the current year of the analysis.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BD$60 calculates the total expected cost, in thousands of dollars, of the modification kits installed in spare engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BD$60 = SUM(Cell '3a 3b 4a 4b'!BD14: Cell '3a 3b 4a 4b'!BD58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

18. Spare Kits - Labor Cost (Column BE)

Column BE calculates the expected cost, in thousands of dollars, of the labor required to modify spare engines for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$BE$14, labeled ProSpareKitLabCost, is

```
[Cell '3a 3b 4a 4b'!$BE$14 = IF(Cell 'Interim'!D$11 *
ProSpareKitInstalled > 0.01, Cell 'Interim'!D$11 *
ProSpareKitInstalled / 1000, 0)].
```

This equals

```
[Cell '3a 3b 4a 4b'!$BE$14 = IF(Cell 'Interim'!D$11 *
Cell '3a 3b 4a 4b'!BC14 > 0.01, Cell 'Interim'!D$11 * Cell
'3a 3b 4a 4b'!BC14 / 1000, 0)].
```

Cell 'Interim'!$D$11 is KitLaborCost and represents the total expected cost of labor per engine modification.

ProSpareKitInstalled is cell '3a 3b 4a 4b'!$BC$14 and represents the number of kits expected to be installed in spare engines for the current year of the analysis.

The IF statement uses the following logic to determine the expected cost, in thousands of dollars, of the labor required to modify the spare engines for each year of the analysis:

A) If the product of the total expected cost of labor per engine modification and the number of kits expected to be installed in spare engines for the current year is greater than 0.01, then the value displayed is the product of the total expected cost of labor per engine modification and the number of kits expected to be installed in spare engines for the current year divided by 1000.

B) If the product of the total expected cost of labor per engine modification and the number of kits expected to be installed in spare engines for the current year is less than or equal to 0.01, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BE$60 calculates the total expected cost, in thousands of dollars, of the labor required to modify spare engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BE$60 = SUM(Cell '3a 3b 4a 4b'!BE14: Cell '3a 3b 4a 4b'!BE58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

E. DESCRIPTION OF PAGE 4B

Page 4b of the CEA Model provides cost information, in thousands of dollars, on the proposed engine configuration where Page 4a left off. Page 4b calculates the costs associated with the scheduled and unscheduled maintenance events detailed on Page 4a, parts support, production and fuel. The page contains eighteen columns, all of which are used to calculate values or display data.

1. Calendar Year (Column BG)

Column BG displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model. The reference in cell '3a 3b 4a 4b'!$BG$14 is

[Cell '3a 3b 4a 4b'!$BG$14 = Cell 'Standard History'!B14].

Cell 'Standard History'!$B$14 is labeled FirstYrStdHistory and represents the first year of the analysis. FirstYrStdHistory is entered by the user in cell 32 of the applicable fleet in the Std_hist.xls file.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

2. One-Time Costs (Column BH)

Column BH calculates the one-time costs, in thousands of dollars, associated with developing the engine modification and introducing it to the fleet. The formula in cell '3a 3b 4a 4b'!$BH$14, labeled CurYrPro1TimCost, is

[Cell '3a 3b 4a 4b'!$BH$14 = IF(Cell '3a 3b 4a 4b'!BG14 = MIN(Cell 'Input'!$D$28, Cell 'Input'!$D$29), (Cell 'Input'!$D$21 + Cell 'Input'!$D$19 + Cell 'Input'!$D$20 + Cell 'Interim'!$D$80 / 1000, 0) + IF(Cell '3a 3b 4a 4b'!BG14 = (Cell 'Input'!$G$8 + 1), Cell 'Input'!$F$68 / 1000, 0)].

Cell '3a 3b 4a 4b'!$BG$14 is the calendar year for the current year of the analysis.

Cell 'Input'!$D$28 is labeled ProdIncorpYr and represents the contractor's estimate of the year when the change will begin to be incorporated into engines in production.

Cell 'Input'!$D$29 is labeled FieldIncorpYr and represents the contractor's estimate of the year when the change will begin to be incorporated into engines already produced.

Cell 'Input'!$D$21 is labeled ToolSE.Cost and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification.

Cell 'Input'!$D$19 is labeled TechPubsCost and represents the total cost of the modification or creation of technical publications due to the engine change.

Cell 'Input'!$D$20 is labeled TctoCost and represents the total cost to produce a Time Compliance Technical Order or Technical Directive if required by the change.

Cell 'Interim'!$D$80 is labeled PnIntroCost and represents the total expected cost of introducing new parts required by the engine change.

Cell 'Input'!$G$8 is labeled YrDollar and represents the base year for the calculation of net present value in the model. To change YrDollar, the user must make a change to the applicable standard fleet in the Std_hist.xls file in row 8.

Cell 'Input'!$F$68 is labeled EngineeringDevelopCost and represents the future cost to fund the design and verification of a task related to the component being modified.

MIN is an EXCEL worksheet function that returns the minimum of a set of values contained in a specified field.

The IF statement uses the following logic to determine the one-time costs, in thousands of dollars, associated with developing the engine modification and introducing it to the fleet:

A) If the calendar year for the current year of the analysis equals the earlier of the contractor's estimate of the year when the change will begin to be incorporated into engines in production and the contractor's estimate of the year when the change will begin to be incorporated into engines already produced, then the value displayed is the sum of the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification, the total cost of the modification or creation of technical publications due to the engine change, the total cost to produce a Time Compliance Technical Order or Technical Directive if required by the change and the total expected cost of introducing new parts required by the engine change divided by 1000. Plus,

1) If the calendar year for the current year of the analysis equals the base year for the calculation of net present value in the model plus one, then add the future cost to fund the design and verification of a task related to the component being modified divided by 1000 to the value.

2) If the calendar year for the current year of the analysis does not equal the base year for the calculation of net present value in the model plus one, then add zero to the value.

B) If the calendar year for the current year of the analysis does not equal the earlier of the contractor's estimate of the year when the change will begin to be incorporated into engines in production and the contractor's estimate of the year when the change will begin to be incorporated into engines already produced, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BH$60 calculates the total expected one-time costs, in thousands of dollars, associated with developing the engine modification and introducing it to the fleet over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BH$60 = SUM(Cell '3a 3b 4a 4b'!BH14:
Cell '3a 3b 4a 4b'!BH58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

3. Delta Prod. Cost (Column BI)

Column BI calculates the expected annual difference in production costs between modified and unmodified engines in thousands of dollars. The formula in cell '3a 3b 4a 4b'!$BI$14 is

[Cell '3a 3b 4a 4b'!$BI$14 = ProEngModProd * Cell
'Input'!$D$15 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BI$14 = Cell '3a 3b 4a 4b'!AO14 * Cell
'Input'!$D$15 / 1000].

ProEngModProd is cell '3a 3b 4a 4b'!$AO$14 and represents the number of engines modified during production in the current year.

Cell 'Input'!$D$15 is labeled DeltaProdCost and describes the difference in the price of the production engine due to the change.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BI$60 calculates the total expected difference in production costs, in thousands of dollars, between modified and unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BI$60 = SUM(Cell '3a 3b 4a 4b'!BI14:
Cell '3a 3b 4a 4b'!BI58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

4. Part Maint Cost - Unmod (Column BJ)

Column BJ calculates the expected annual cost, in thousands of dollars, to maintain parts in the supply system for unmodified engines. The formula in cell '3a 3b 4a 4b'!$BJ$14 is

[Cell '3a 3b 4a 4b'!$BJ$14 = IF(ProAvgUnmodEng > 0, Cell
'Input'!E$64 * Cell 'Input'!G$15 / 1000, 0)].

This equals

[Cell '3a 3b 4a 4b'!$BJ$14 = IF(Cell '3a 3b 4a 4b'!AP14 > 0,
Cell 'Input'!E$64 * Cell 'Input'!G$15 / 1000, 0)].

ProAvgUnmodEng is cell '3a 3b 4a 4b'!$AP$14 and represents the average number of unmodified engines in the fleet for the current year of the analysis.

Cell 'Input'!$E$64 is labeled CurPartNums and represents the number of parts to be removed from the system under the current configuration.

Cell 'Input'!$G$15 is labeled PnMatinCost and represents the annual cost of supporting a single part.

The IF statement uses the following logic to determine the expected annual cost, in thousands of dollars, to maintain part numbers for unmodified engines:

A) If the average number of unmodified engines in the fleet for the current year of the analysis is greater than zero, then the value displayed is the product of the number of parts to be removed from the system under the current configuration and the annual cost of supporting a single part divided by 1000.

B) If the average number of unmodified engines in the fleet for the current year of the analysis is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BJ$60 calculates the total expected cost, in thousands of dollars, to maintain parts in the supply system for unmodified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BJ$60 = SUM(Cell '3a 3b 4a 4b'!BJ14:
Cell '3a 3b 4a 4b'!BJ58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

5. Part Maint Cost - Mod (Column BK)

Column BK calculates the expected annual cost, in thousands of dollars, to maintain parts in the supply system for modified engines. The formula in cell '3a 3b 4a 4b'!$BK$14 is

[Cell '3a 3b 4a 4b'!$BK$14 = IF(ProAvgModEng > 0, Cell
'Input'!F$64 * Cell 'Input'!G$15 / 1000, 0)].

This equals

[Cell '3a 3b 4a 4b'!$BK$14 = IF(Cell '3a 3b 4a 4b'!AQ14 > 0, Cell 'Input'!F$64 * Cell 'Input'!G$15 / 1000, 0)].

ProAvgModEng is cell '3a 3b 4a 4b'!$AQ$14 and represents the average number of engines expected to be modified in the current year.

Cell 'Input'!$F$64 is labeled ProPartNums and represents the number of parts to be added to the system with the proposed engine configuration.

Cell 'Input'!$G$15 is labeled PnMatinCost and represents the annual cost of supporting a single part.

The IF statement uses the following logic to determine the expected annual cost, in thousands of dollars, to maintain part numbers for unmodified engines:

A) If the average number of engines expected to be modified in the current year is greater than zero, then the value displayed is the product of the number of parts to be added to the system with the proposed engine configuration and the annual cost of supporting a single part divided by 1000.

B) If the average number of engines expected to be modified in the current year is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BK$60 calculates the total expected cost, in thousands of dollars, to maintain parts in the supply system for modified engines over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BK$60 = SUM(Cell '3a 3b 4a 4b'!BK14: Cell '3a 3b 4a 4b'!BK58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BK$61 calculates the total expected cost, in thousands of dollars, to maintain part numbers for modified and unmodified engines combined over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BK$61 = Cell '3a 3b 4a 4b'!BJ60 + Cell '3a 3b 4a 4b'!BK60].

Cell '3a 3b 4a 4b'!$BJ$60 represents the total expected cost, in thousands of dollars, to maintain parts in the supply system for unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$BK$60 represents the total expected cost, in thousands of dollars, to maintain parts in the supply system for modified engines over the period of the analysis.

6. Unmod Unsch Cost - Labor (Column BL)

Column BL calculates the expected annual cost of labor, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BL$14 is

[Cell '3a 3b 4a 4b'!$BL$14 = ProUnschEvtUnmod * Cell 'Interim'!D$42 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BL$14 = Cell '3a 3b 4a 4b'!AT14 * Cell 'Interim'!D$42 / 1000].

ProUnschEvtUnmod is cell '3a 3b 4a 4b'!$AT$14 and represents the expected number of unscheduled maintenance events generated by the component being modified on unmodified engines in the current year.

Cell 'Interim'!$D$42, labeled CurUnschTotLaborCost_Evt, represents the total expected cost of labor for maintenance on the current engine configuration generated by unscheduled maintenance events.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BL$60 calculates the total expected cost of labor, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BL$60 = SUM(Cell '3a 3b 4a 4b'!BL14:
Cell '3a 3b 4a 4b'!BL58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BL$63 displays the total expected cost of labor for maintenance on the current engine configuration generated per unscheduled maintenance event in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BL$63 = Cell 'Interim'!$D$42 / 1000].

Cell 'Interim'!$D$42, labeled CurUnschTotLaborCost_Evt, represents the total expected cost of labor for maintenance on the current engine configuration generated by unscheduled maintenance events.

7. Unmod Unsch Cost - Material (Column BM)

Column BM calculates the expected annual cost, in thousands of dollars, of materials used in unmodified engines generated by unscheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BM$14 is

[Cell '3a 3b 4a 4b'!$BM$14 = IF(ProAvgModEng = 0, CurUnmodUnschLabCost, (MAX(IF(Cell 'Input'!D$14 = 0, ProUnschEvtUnmod * Cell 'Interim'!D$53, ProUnschEvtUnmod * Cell 'Interim'!D$53 - UnschKitIncorpEvts * Cell 'Standard History'!D$14 / 12 * Cell 'Interim'!D$47 * Cell 'Input'!D$25), ProUnschEvtUnmod * (Cell 'Interim'!D$49 + Cell 'Interim'!D$52)) / 1000))].

This equals

[Cell '3a 3b 4a 4b'!$BM$14 = IF(Cell '3a 3b 4a 4b'!AQ14 = 0, Cell '3a 3b 4a 4b'!AA14, (MAX(IF(Cell 'Input'!D$14 = 0, Cell '3a 3b 4a 4b'!AT14 * Cell 'Interim'!D$53, Cell '3a 3b 4a 4b'!AT14 * Cell 'Interim'!D$53 - Cell '3a 3b 4a 4b'!CI14 * Cell 'Standard History'!D$14 / 12 * Cell 'Interim'!D$47 * Cell 'Input'!D$25), Cell '3a 3b 4a 4b'!AT14 * (Cell 'Interim'!D$49 + Cell 'Interim'!D$52)) / 1000))].

ProAvgModEng is cell '3a 3b 4a 4b'!$AQ$14 and represents the average number of engines expected to be modified in the current year.

CurUnmodUnschLabCost is cell '3a 3b 4a 4b'!$AA$14 and represents the expected cost, in thousands of dollars, of materials generated by unscheduled maintenance events for engines with the current configuration for the current year.

Cell 'Input'!$D$14 is labeled KitCostReplaceNormalMaint and is a switch that identifies if the kit cost is in addition to the normal maintenance material cost ("No" = 0) or if it replaces it ("Yes" = 1).

ProUnschEvtUnmod is cell '3a 3b 4a 4b'!$AT$14 and represents the expected number of unscheduled maintenance events generated by the component being modified on unmodified engines in the current year.

UnschKitIncorpEvts is cell '3a 3b 4a 4b'!$CI$14 and represents the expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance in the current year.

Cell 'Interim'!$D$53 is labeled CurTotMatCostUnschEvt and represents the total expected material cost per unscheduled maintenance event for the current engine configuration.

Cell 'Standard History'!$D$14, labeled MoAvailFieldMod, represents the number of months during the current year that the modification will be incorporated into engines in the field.

Cell 'Interim'!$D$47 is labeled CurUnschTotMatCost_Evt and represents the expected material cost per unscheduled maintenance event at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

CurUnschTestLabFuelCost_Evt is cell'Interim'!$D$49 and represents the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

The label CurUnschSecIncidentalDamCost_Evt applies to cell 'Interim'!$D$52 and represents the cost of damage to other engine parts or components caused by failure of the component being modified and expected incidental costs for each unscheduled maintenance event not covered by any other input element.

MAX is an EXCEL worksheet function that returns the maximum of a set of values contained in a specified field.

The IF statement uses the following logic to determine the expected annual cost, in thousands of dollars, of materials used in unmodified engines generated by unscheduled maintenance events:

A) If the average number of engines expected to be modified in the current year is zero, then the value displayed is the expected cost, in thousands of dollars, of materials generated by unscheduled maintenance events for engines with the current configuration for the current year.

B) If the average number of engines expected to be modified in the current year is not zero, then the value displayed is the larger of the following two numbers:

1) If the kit cost does not replace the normal maintenance material cost, then the first number is the product of the expected number of unscheduled maintenance events generated by the component being modified on unmodified engines in the current year and the total expected material cost per unscheduled maintenance event for the current engine configuration. This product is then divided by 1000.

2) If the kit cost does replace the normal maintenance material cost, then the first number is the product of the expected number of unscheduled maintenance events generated by the component being modified on

unmodified engines in the current year and the total expected material cost per unscheduled maintenance event for the current engine configuration minus the product of the expected number of kit incorporation events generated by unscheduled maintenance in the current year, the number of months during the current year that the modification will be incorporated into engines in the field divided by twelve, the expected material cost per unscheduled maintenance event at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified and the percentage of unscheduled maintenance during which modifications can be performed. This product is divided by 1000.

3) The second number is the product of the expected number of unscheduled maintenance events generated by the component being modified on unmodified engines in the current year and the sum of the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels and the cost of damage to other engine parts or components caused by failure of the component being modified and expected incidental costs for each unscheduled maintenance event not covered by any other input element. This value is divided by 1000.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BM$60 calculates the total expected cost of materials, in thousands of dollars, used in unmodified engines generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BM$60 = SUM(Cell '3a 3b 4a 4b'!BM14:
Cell '3a 3b 4a 4b'!BM58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BM$61 calculates the total expected cost of labor and materials, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events. Kit installation costs are not included. The formula in cell '3a 3b 4a 4b'!$BM$61 is

[Cell '3a 3b 4a 4b'!$BM$61 = SUM(Cell '3a 3b 4a 4b'!BL60:
Cell '3a 3b 4a 4b'!BM60)].

Cell '3a 3b 4a 4b'!$BL$60 represents the total expected cost of labor, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BM$60 calculates the total expected cost of materials, in thousands of dollars, used in unmodified engines generated by unscheduled maintenance events over the period of the analysis.

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BM$63 displays the total expected material cost per unscheduled maintenance event for the current engine configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BM$63 = Cell 'Interim'!$D$53 / 1000].

Cell 'Interim'!$D$53 is labeled CurTotMatCostUnschEvt and represents the total expected material cost per unscheduled maintenance event for the current engine configuration.

8. Unmod Sched Cost - Labor (Column BN)

Column BN calculates the expected annual cost, in thousands of dollars, of labor for unmodified engines generated by scheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BN$14 is

[Cell '3a 3b 4a 4b'!$BN$14 = ProSchEvtUnmod * Cell 'Interim'!D$28 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BN$14 = Cell '3a 3b 4a 4b'!AV14 * Cell 'Interim'!D$28 / 1000].

ProSchEvtUnmod is cell '3a 3b 4a 4b'!$AV$14 and represents the expected number of scheduled maintenance events generated by the component being modified on unmodified engines.

Cell 'Interim'!$D$28 is labeled CurSchTotLaborCost_Evt and represents the total expected cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BN$60 calculates the total expected cost of labor, in thousands of dollars, for unmodified engines generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BN$60 = SUM(Cell '3a 3b 4a 4b'!BN14:
Cell '3a 3b 4a 4b'!BN58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BN$63 displays the total expected per event cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BN$63 = Cell 'Interim'!$D$28 / 1000].

Cell 'Interim'!$D$28 is labeled CurSchTotLaborCost_Evt and represents the total expected cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events.

9. **Unmod Sched Cost - Material (Column BO)**

Column BO calculates the expected annual cost of materials, in thousands of dollars, for unmodified engines generated by scheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BO$14 is

[Cell '3a 3b 4a 4b'!$BO$14 = (IF(ProAvgModEng <= 0,
CurUnmodSchMatCost, ProSchEvtUnmod * MAX(IF(Cell
'Input'!D$14 = 0, Cell 'Interim'!D$36, Cell 'Interim'!D$36 -
Cell 'Interim'!D$33 * 'Standard History'!D14 / 12 * Cell
'Input'!D$24), Cell 'Interim'!D$35) / 1000))].

This equals

[Cell '3a 3b 4a 4b'!$BO$14 = (IF(Cell '3a 3b 4a 4b'!AQ14 <=
0, Cell '3a 3b 4a 4b'!AC14, Cell '3a 3b 4a 4b'!AV14 *
MAX(IF(Cell 'Input'!D$14 = 0, Cell 'Interim'!D$36, Cell
'Interim'!D$36 - Cell 'Interim'!D$33 * 'Standard
History'!D14 / 12 * Cell 'Input'!D$24), Cell 'Interim'!D$35)
/ 1000))].

ProAvgModEng is cell '3a 3b 4a 4b'!$AQ$14 and represents the average number of engines expected to be modified in the current year.

CurUnmodSchMatCost is cell '3a 3b 4a 4b'!$AC$14 and represents the expected annual cost of materials, in thousands of dollars, generated by scheduled maintenance events for engines with the current configuration.

ProSchEvtUnmod is cell '3a 3b 4a 4b'!$AV$14 and represents the expected number of scheduled maintenance events generated by the component being modified on unmodified engines.

Cell 'Input'!$D$14 is labeled KitCostReplaceNormalMaint and is a switch that identifies if the kit cost is in addition to the normal maintenance material cost ("No" = 0) or if it replaces it ("Yes" = 1).

Cell 'Interim'!$D$36 is labeled CurTotMatCostSch and represents the total expected cost of materials per scheduled maintenance event on the current engine configuration.

Cell 'Interim'!$D$33 is labeled CurSchTotMatCost_Evt and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

Cell 'Standard History'!$D$14, labeled MoAvailFieldMod, represents the number of months during the current year that the modification will be incorporated into engines in the field.

Cell 'Input'!$D$24, labeled SchPctEvtMod, represents the percentage of scheduled maintenance events during which modifications can be performed.

CurSchTestLabFuelCost_Evt is cell 'Interim'!$D$35 and represents the expected cost of labor and fuel used to test the current engine configuration after scheduled maintenance at the Organizational and Intermediate levels.

MAX is an EXCEL worksheet function that returns the maximum of a set of values contained in a specified field.

The IF statement uses the following logic to determine the expected annual cost of materials, in thousands of dollars, for unmodified engines generated by scheduled maintenance events:

A) If the average number of engines expected to be modified in the current year is less than or equal to zero, then the value displayed is the expected annual cost of materials, in thousands of dollars, generated by scheduled maintenance events for engines with the current configuration.

B) If the average number of engines expected to be modified in the current year is greater than zero, then the value displayed is the product of the expected number of scheduled maintenance events generated by the component being modified on unmodified engines and the larger of the two following numbers:

1) If the kit cost does not replace the normal maintenance material cost, then the first number is the total expected cost of materials per scheduled maintenance event on the current engine configuration divided by 1000.

2) If the kit cost does replace the normal maintenance material cost, then the first number is the total expected cost of materials per scheduled maintenance event on the current engine configuration minus the product of the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels (which includes the cost of replacing the component being modified), the number of months during the current year that the modification will be incorporated into engines in the field divided by twelve and the percentage of scheduled maintenance events during which modifications can be performed. This number is divided by 1000.

3) The second number is the expected cost of labor and fuel used to test the current engine configuration after scheduled maintenance at the Organizational and Intermediate levels divided by 1000.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BO$60 calculates the total expected cost of materials, in thousands of dollars, for unmodified engines generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BO$60 = SUM(Cell '3a 3b 4a 4b'!BO14:
Cell '3a 3b 4a 4b'!BO58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BO$61 calculates the total expected cost of materials and labor combined, in thousands of dollars, for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BO$61 = SUM(Cell '3a 3b 4a 4b'!BN60: Cell '3a 3b 4a 4b'!BO60)].

Cell '3a 3b 4a 4b'!$BN$60 represents the total expected cost of labor, in thousands of dollars, for unmodified engines generated by scheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BO$60 calculates the total expected cost of materials, in thousands of dollars, for unmodified engines generated by scheduled maintenance events over the period of the analysis.

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BO$63 displays the total expected cost of materials per scheduled maintenance event on the current engine configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BO$63 = Cell 'Interim'!$D$36 / 1000].

Cell 'Interim'!$D$36 is labeled CurTotMatCostSch and represents the total expected cost of materials per scheduled maintenance event on the current engine configuration.

10. Mod Unsched Cost - Labor (Column BP)

Column BP calculates the expected annual cost of labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BP$14 is

[Cell '3a 3b 4a 4b'!$BP$14 = (Cell 'Interim'!F$40 + Cell 'Interim'!F$41) * ProUnschEvtUnmod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BP$14 = (Cell 'Interim'!F$40 + Cell 'Interim'!F$41) * Cell '3a 3b 4a 4b'!AU14 / 1000].

Cell 'Interim'!$F$40 is labeled ProUnschOILaborCost_Evt and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$F$41, labeled ProUnschDepLaborCost_Evt, represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the proposed engine configuration at the Depot level.

ProUnschEvtMod is cell '3a 3b 4a 4b'!$AU$14 and represents the expected number of unscheduled maintenance events generated by the component being modified on modified engines in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BP$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BP$60 = SUM(Cell '3a 3b 4a 4b'!BP14: Cell '3a 3b 4a 4b'!BP58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BP$63 displays the total expected cost of labor, in thousands of dollars, for maintenance on the proposed engine configuration generated per unscheduled maintenance event. The cell formula is

[Cell '3a 3b 4a 4b'!$BP$63 = Cell 'Interim'!$F$42 / 1000].

Cell 'Interim'!$F$42, labeled ProUnschTotLaborCost_Evt, represents the total expected cost of labor for maintenance on the proposed engine configuration generated per unscheduled maintenance events.

11. Mod Unsched Cost - Materials (Column BQ)

Column BQ calculates the expected annual cost of materials, in thousands of dollars, for modified engines generated by unscheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BQ$14 is

[Cell '3a 3b 4a 4b'!$BQ$14 = (Cell 'Interim'!F$46 + Cell 'Interim'!F$44 + Cell 'Interim'!F$45 + Cell 'Interim'!F$49 + Cell 'Interim'!F$52) * ProUnschEvtMod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BQ$14 = (Cell 'Interim'!F$46 + Cell 'Interim'!F$44 + Cell 'Interim'!F$45 + Cell 'Interim'!F$49 + Cell 'Interim'!F$52) * Cell '3a 3b 4a 4b'!AU14 / 1000].

Cell 'Interim'!$F$46 is labeled ProUnschScrapCost_Evt and represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the proposed engine configuration.

Cell 'Interim'!$F$44 is labeled ProUnschOIRepCost_Evt and represents the expected cost of materials used during unscheduled maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$F$45 is labeled CurUnschDepRepCost_Evt and represents the expected cost of unscheduled maintenance on the proposed engine configuration at the Depot level.

ProUnschTestLabFuelCost_Evt is cell 'Interim'!$F$49 and represents the expected cost of labor and fuel used to test the proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

Cell 'Interim'!$F$52 represents the cost of damage to other engine parts or components caused by failure of the component being modified and expected incidental costs for each unscheduled maintenance event not covered by any other input element. ProUnschSecIncidentalDamCost_Evt is the variable name assigned to cell 'Interim'!$F$52.

ProUnschEvtMod is cell '3a 3b 4a 4b'!$AU$14 and represents the expected number of unscheduled maintenance events generated by the component being modified on modified engines in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BQ$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BQ$60 = SUM(Cell '3a 3b 4a 4b'!BQ14:
Cell '3a 3b 4a 4b'!BQ58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BQ$61 calculates the total expected cost of materials and labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BQ$61 = SUM(Cell '3a 3b 4a 4b'!BP60: Cell '3a 3b 4a 4b'!BQ60)].

Cell '3a 3b 4a 4b'!$BP$60 represents the total expected cost of labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BQ$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis.

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BQ$63 displays the total expected material cost per unscheduled maintenance event for the proposed engine configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BQ$63 = Cell 'Interim'!$F$53 / 1000].

Cell 'Interim'!$F$53 is labeled ProTotMatCostUnschEvt and represents the total expected material cost per unscheduled maintenance event for the proposed engine configuration.

12. Mod Sched Cost - Labor (Column BR)

Column BR calculates the expected annual cost of labor, in thousands of dollars, for modified engines generated by scheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BR$14 is

[Cell '3a 3b 4a 4b'!$BR$14 = (Cell 'Interim'!F$26 + Cell 'Interim'!F$27) * ProSchEvtMod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BR$14 = (Cell 'Interim'!F$26 + Cell 'Interim'!F$27) * Cell '3a 3b 4a 4b'!AW14 / 1000].

Cell 'Interim'!$F$26 is labeled ProSchOILaborCost_Evt and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$F$27 is labeled ProSchDepLaborCost_Evt and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

ProSchEvtMod is cell '3a 3b 4a 4b'!$AW$14 and represents the expected number of scheduled maintenance events generated by the component being modified on modified engines.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BR$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BR$60 = SUM(Cell '3a 3b 4a 4b'!BR14: Cell '3a 3b 4a 4b'!BR58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BR$63 displays the total expected cost of labor for maintenance on the proposed engine configuration generated by scheduled maintenance events in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BR$63 = Cell 'Interim'!$F$28 / 1000].

Cell 'Interim'!$F$28 is labeled ProSchTotLaborCost_Evt and represents the total expected cost of labor for maintenance on the proposed engine configuration generated by scheduled maintenance events.

13. Mod Sched Cost - Materials (Column BS)

Column BS calculates the expected annual cost of materials, in thousands of dollars, for modified engines generated by scheduled maintenance events. The formula in cell '3a 3b 4a 4b'!$BS$14, labeled ProModSchMatCost, is

[Cell '3a 3b 4a 4b'!$BS$14 = (Cell 'Interim'!F$30 + Cell 'Interim'!F$31 + Cell 'Interim'!F$32 + Cell 'Interim'!F$35) * ProSchEvtMod / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BS$14 = (Cell 'Interim'!F$30 + Cell 'Interim'!F$31 + Cell 'Interim'!F$32 + Cell 'Interim'!F$35) * Cell '3a 3b 4a 4b'!AW14 / 1000].

Cell 'Interim'!$F$30 is labeled ProSchOIRepCost_Evt and represents the expected cost of materials during scheduled maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

Cell 'Interim'!$F$31 is labeled ProSchDepRepCost and represents the expected cost of materials during scheduled maintenance on the proposed engine configuration at the Depot level.

Cell 'Interim'!$F$32 is labeled ProSchScrapCost_Evt and represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the proposed engine configuration.

ProSchTestLabFuelCost_Evt is cell 'Interim'!$F$35 and represents the expected cost of labor and fuel used to test the proposed engine configuration after scheduled maintenance at the Organizational and Intermediate levels.

ProSchEvtMod is cell '3a 3b 4a 4b'!$AW$14 and represents the expected number of scheduled maintenance events generated by the component being modified on modified engines.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BS$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BS$60 = SUM(Cell '3a 3b 4a 4b'!BS14:
Cell '3a 3b 4a 4b'!BS58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BS$61 calculates the total expected cost of materials and labor combined, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BS$61 = SUM(Cell '3a 3b 4a 4b'!BR60:
Cell '3a 3b 4a 4b'!BS60)].

Cell '3a 3b 4a 4b'!$BR$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BS$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis.

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$BS$63 displays the total expected cost of materials per scheduled maintenance event on the proposed engine configuration in thousands of dollars. The cell formula is

[Cell '3a 3b 4a 4b'!$BS$63 = Cell 'Interim'!$F$36 / 1000].

Cell 'Interim'!$F$36 is labeled ProTotMatCostSch and represents the total expected cost of materials per scheduled maintenance event on the proposed engine configuration.

14. Proposed Total Cost (Column BT)

Column BT calculates the total annual expected logistics support costs, in thousands of dollars, for the proposed engine configuration, less operational fuel costs. The formula in cell '3a 3b 4a 4b'!$BT$14, labeled ProTotCost, is

[Cell '3a 3b 4a 4b'!$BT$14 = SUM(Cell '3a 3b 4a 4b'!BH14: Cell '3a 3b 4a 4b'!BS14) + SUM(Cell '3a 3b 4a 4b'!BA14: Cell '3a 3b 4a 4b'!BB14) + SUM(Cell '3a 3b 4a 4b'!BD14: Cell '3a 3b 4a 4b'!BE14)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BT$60 calculates the total expected logistics support costs, in thousands of dollars, for the proposed engine configuration, less operational fuel costs, over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BT$60 = SUM(Cell '3a 3b 4a 4b'!BT14: Cell '3a 3b 4a 4b'!BT58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

15. Operational Fuel - Gal / Yr (Column BU)

Column BU calculates the expected annual number of gallons of fuel that will be consumed operationally by engines with the proposed configuration for each year of the analysis. The result is displayed in thousands of gallons. The formula in cell '3a 3b 4a 4b'!$BU$14, labeled ProOperGalYr, is

[Cell '3a 3b 4a 4b'!$AI$14 = IF(Cell 'Input'!$F$66 <> 0, (CurYrProUnmodEfh + CurYrProModEfh * (1 - Cell 'Input'!$F$66)) * Cell 'Standard History'!$G$63, "N/A")].

This equals

[Cell '3a 3b 4a 4b'!$AI$14 = IF(Cell 'Input'!$F$66 <> 0, (Cell '3a 3b 4a 4b'!AR14 + Cell '3a 3b 4a 4b'!AS14 * (1 - Cell 'Input'!$F$66)) * Cell 'Standard History'!$G$63, "N/A")].

Cell 'Input'!$F$66 is labeled PctImpSFC and represents the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration.

CurYrProUnmodEfh is cell '3a 3b 4a 4b'!$AR$14 and represents the expected number of engine flight hours, in thousands of hours, logged by unmodified engines for the current year.

CurYrProModEfh is cell '3a 3b 4a 4b'!$AS$14 and represents the expected number of engine flight hours, in thousands of hours, logged by modified engines for the current year.

Cell 'Standard History'!$G$63 is labeled FltFuelGH and represents the expected specific fuel consumption rate of the current engine configuration in gallons per hour.

The IF statement uses the following logic to determine the expected annual number of gallons of fuel that will be consumed operationally by engines with the proposed configuration:

A) If the expected percentage of improvement in specific fuel consumption of the proposed configuration over the current engine configuration does not equal zero, then the value displayed is the product of the expected number of engine flight hours, in thousands of hours, logged by unmodified engines for the current year plus the expected number of engine flight hours, in thousands of hours, logged by modified engines for the current year multiplied by the product of one minus the expected percentage of improvement in specific fuel consumption of the proposed configuration over the current engine configuration and the expected specific fuel consumption rate of the current engine configuration in gallons per hour.

B) If the expected percentage of improvement in specific fuel consumption of the proposed configuration over the current engine configuration does equal zero, then "N/A" is displayed.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BU$60 calculates the total expected number of gallons of fuel that will be consumed operationally by engines with the proposed configuration in thousands of gallons over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BU$60 = SUM(Cell '3a 3b 4a 4b'!BU14:
Cell '3a 3b 4a 4b'!BU58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

16. Operational Fuel - Cost (Column BV)

Column BV calculates the expected annual operational fuel costs, in thousands of dollars, for engines with the proposed configuration. The formula in cell '3a 3b 4a 4b'!$BV$14, labeled ProOperFuelCost, is

[Cell '3a 3b 4a 4b'!$BV$14 = IF(Cell 'Input'!$F$66 <> 0,
ProOperGalYr * Cell 'Input'!$G$17, "N/A")].

This equals

[Cell '3a 3b 4a 4b'!$AJ$14 = IF(Cell 'Input'!$F$66 <> 0,
Cell '3a 3b 4a 4b'!BU14 * Cell 'Input'!$G$17, "N/A")].

Cell 'Input'!$F$66 is labeled PctImpSFC and represents the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration.

ProOperGalYr is cell '3a 3b 4a 4b'!$BU$14 and represents the expected number of gallons of fuel, in thousands of gallons, that will be consumed operationally by engines with the proposed engine configuration during the current year.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon.

The IF statement uses the following logic to determine the expected annual operational fuel costs, in thousands of dollars, for the proposed engine configuration:

A) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does not equal zero, then the value displayed is the product of the expected number of gallons of fuel, in thousands of gallons, that will be consumed operationally by engines with the proposed engine configuration during the current year and the cost of fuel per gallon.

B) If the expected percentage of improvement in specific fuel consumption of the proposed engine configuration over the current engine configuration does equal zero, then "N/A" is displayed.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BV$60 calculates the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BV$60 = SUM(Cell '3a 3b 4a 4b'!BV14:
Cell '3a 3b 4a 4b'!BV58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

17. A/C Loss Delta (Column BW)

Column BW calculates the expected change in the annual cost of losing aircraft (A/C) in thousands of dollars. Aircraft loss costs are those costs incurred when the failure of the component being modified causes the destruction of the aircraft. The formula in cell '3a 3b 4a 4b'!$BW$14, labeled ProACLossDelta, is

[Cell '3a 3b 4a 4b'!$BW$14 = -ProACLossPerYr * Cell
'Standard History'!$G$64 / 1000].

This equals

[Cell '3a 3b 4a 4b'!$BW$14 = - Cell '3a 3b 4a 4b'!AY14 *
Cell 'Standard History'!$G$64 / 1000].

ProACLossPerYr is cell '3a 3b 4a 4b'!$AY$14 and represents the number of aircraft, with the proposed engine configuration, expected to be lost during the current year.

AirCraftCost is cell 'Standard History'!$G$64 and represents the cost, in fiscal year dollars, of the aircraft in which the modification is being done.

The cell references for subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BW$60 calculates the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BW$60 = SUM(Cell '3a 3b 4a 4b'!BW14: Cell '3a 3b 4a 4b'!BW58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

18. Total Cost Prop Config w/ Fuel, A/C (Column BX)

Column BX calculates, in thousands of dollars, the expected annual logistics support costs for the proposed engine configuration, including operational fuel and aircraft loss due to a failure of the component being modified. The formula in cell '3a 3b 4a 4b'!$BX$14, labeled TotCurCostPlusACLoss, is

[Cell '3a 3b 4a 4b'!$BX$14 = ProTotCost + ProOperFuelCost + ProACLossDelta].

This equals

[Cell '3a 3b 4a 4b'!$BX$14 = Cell '3a 3b 4a 4b'!BT14 + Cell '3a 3b 4a 4b'!BV14 + Cell '3a 3b 4a 4b'!BW14].

ProTotCost is cell '3a 3b 4a 4b'!$BT$14 and represents the total expected logistics support costs, in thousands of dollars, for the proposed engine configuration, less operational fuel and aircraft loss costs for the current year. Aircraft loss costs are those costs incurred when the failure of the component being modified causes the destruction of the aircraft.

ProOperFuelCost is cell '3a 3b 4a 4b'!$BV$14 and represents the expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration in the current year.

ProACLossDelta is cell '3a 3b 4a 4b'!$BW$14 and represents the expected cost of losing aircraft, in thousands of dollars, with the proposed engine configuration in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$BX$60 calculates the total expected logistics support costs, in thousands of dollars, for the proposed engine configuration, including operational fuel and A/C loss over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$BX$60 = SUM(Cell '3a 3b 4a 4b'!BX14:
Cell '3a 3b 4a 4b'!BX58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

F. DESCRIPTION OF THE "BLUE" EQUATIONS

The "blue" equations are those columns to the right of Page 4b that begin with column BZ of the '3a 3b 4a 4b' sheet. Eleven columns make up the "blue" equations section and deal primarily with calculating the number of field upgrades to perform.

1. Scheduled Available Flag (Column BZ)

Column BZ produces a flag to determine if scheduled maintenance inspections may occur. The formula in cell '3a 3b 4a 4b'!$BZ$14, labeled SchAvailFlag, is

[Cell '3a 3b 4a 4b'!$BZ$14 = IF(Cum1stEngEfh < Cell '3a 3b 4a 4b'!$CI$64, 0, IF(Cell '3a 3b 4a 4b'!BZ13 > 0, 1, (Cell '3a 3b 4a 4b'!$CI$64 - Cell '3a 3b 4a 4b'!CA13) / (Cum1stEngEfh - Cell '3a 3b 4a 4b'!CA13)))].

This equals

[Cell '3a 3b 4a 4b'!$BZ$14 = IF(Cell '3a 3b 4a 4b'!CA14 < Cell '3a 3b 4a 4b'!$CI$64, 0, IF(Cell '3a 3b 4a 4b'!BZ13 > 0, 1, (Cell '3a 3b 4a 4b'!$CI$64 - Cell '3a 3b 4a 4b'!CA13) / (Cell '3a 3b 4a 4b'!CA14 - Cell '3a 3b 4a 4b'!CA13)))].

Cum1stEngEfh is cell '3a 3b 4a 4b'!$CA$14 and represents the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the current year.

Cell '3a 3b 4a 4b'!$CI$64 represents the calculated interval in hours between maintenance inspections on unmodified engines.

Cell '3a 3b 4a 4b'!$BZ$13 equals zero and is used only as a placeholder to begin the column BZ calculations. In this context it represents the previous year's scheduled maintenance flag.

Cell '3a 3b 4a 4b'!$CA$13 equals zero and is used only as a placeholder to begin the column CA calculations. In this context it represents the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the previous year.

The IF statement uses the following logic to produce a flag to determine if scheduled maintenance inspections may occur:

A) If the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the current year is less than the interval in hours between maintenance inspections on unmodified engines, then the value displayed is zero.

B) If the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the current year is greater than or equal to the interval in hours between maintenance inspections on unmodified engines, then the value displayed is determined as follows:

1) If the flag indicating if scheduled maintenance inspections may occur is greater than zero for the previous year, then the value displayed is one.

2) If the flag indicating if scheduled maintenance inspections may occur is less than or equal to zero for the previous year, then the value displayed is the interval in hours between maintenance inspections on unmodified engines minus the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the previous year divided by the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the current year minus the cumulative number of engine flight hours the first engine delivered to the fleet has amassed through the previous year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

2. Cumulative 1st Engine EFH (Column CA)

Column CA calculates the expected cumulative number of engine flight hours the first engine delivered to fleet accumulates for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CA$14, labeled Cum1stEngEfh, is

[Cell '3a 3b 4a 4b'!$CA$14 = IF(CurYrCurUnmodEfh > 0, Cell 'Standard History'!H14 + Cell '3a 3b 4a 4b'!CA13, Cell '3a 3b 4a 4b'!CA13)].

This equals

[Cell '3a 3b 4a 4b'!$CA$14 = IF(Cell '3a 3b 4a 4b'!F14 > 0, Cell 'Standard History'!H14 + Cell '3a 3b 4a 4b'!CA13, Cell '3a 3b 4a 4b'!CA13)].

CurYrCurUnmodEfh is cell '3a 3b 4a 4b'!$F$14 and represents the expected annual number of engine flight hours of unmodified engines in thousands of hours.

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine for the current year of the analysis.

Cell '3a 3b 4a 4b'!$CA$13 equals zero and is used only as a placeholder to begin the column CA calculations. In this context it represents the expected cumulative number of engine flight hours the first engine delivered to fleet accumulated through the end of the previous year.

The IF statement uses the following logic to determine the cumulative number of engine flight hours the first

This equals

[Cell '3a 3b 4a 4b'!$CB$14 = IF(Cell '3a 3b 4a 4b'!CC13 + (Cell '3a 3b 4a 4b'!D14 - Cell '3a 3b 4a 4b'!D13) - Cell '3a 3b 4a 4b'!AO14 > 0, Cell '3a 3b 4a 4b'!CC13 + (Cell '3a 3b 4a 4b'!D14 - Cell '3a 3b 4a 4b'!D13) - Cell '3a 3b 4a 4b'!AO14, 0)].

Cell '3a 3b 4a 4b'!$CC$13 equals zero and is used only as a placeholder to begin the column CC calculations.

CurAvgUnmodEng is cell '3a 3b 4a 4b'!$D$14 and represents the average number of unmodified engines in service during the current year.

Cell '3a 3b 4a 4b'!$D$13 equals zero and is used only as a placeholder to begin the column D calculations.

ProEngModProd is cell '3a 3b 4a 4b'!$AO$14 and represents the expected number of engines modified during production in the current year.

The IF statement uses the following logic to determine the average number of flying engines that could be modified in each year of the analysis:

A) If the average number of unmodified engines flying in the current year if no deliveries, phase outs or modifications occur, plus the difference between the average number of unmodified engines in service during the current year and the previous year minus the expected number of engines modified during production in the current year is greater than zero, then the value displayed is the average number of unmodified engines flying in the current year if no deliveries, phase outs or modifications occur plus the difference between the average number of unmodified engines in service during the current year and the previous year minus the number of engines modified during production in the current year.

B) If the average number of unmodified engines flying in the current year if no deliveries, phase outs or modifications occur, plus the difference between the average number of unmodified engines in service during the current year and the previous year minus the expected number of engines modified during production in the current year is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

4. Flying Engines - Not Modified (En) (Column CC)

Column CC calculates the expected number of engines left unmodified at the end of each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CC$14, labeled FlyEngNotModEn, is

[Cell '3a 3b 4a 4b'!$CC$14 = IF(TotKitIncorpRate > CritIncorpRate, 0, FlyEngPotenForModEo - CurYrProEngKitInstal)].

This equals

[Cell '3a 3b 4a 4b'!$CC$14 = IF(Cell '3a 3b 4a 4b'!CH14 > Cell '3a 3b 4a 4b'!CD14, 0, Cell '3a 3b 4a 4b'!CB14 - Cell '3a 3b 4a 4b'!AZ14)].

TotKitIncorpRate is cell '3a 3b 4a 4b'!$CH$14 and represents the engine modification incorporation rate in events per 1000 engine flight hours.

CritIncorpRate is cell '3a 3b 4a 4b'!$CD$14 and represents the incorporation rate necessary to modify all engines available for modification for the current year.

FlyEngPotenForModEo is cell '3a 3b 4a 4b'!$CB$14 and represents the average number of flying engines that could be modified in the current year of the analysis.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The IF statement uses the following logic to determine the number of engines left unmodified at the end of each year of the analysis:

A) If the engine modification incorporation rate, in events per 1000 engine flight hours, is greater than the incorporation rate necessary to modify all engines available for modification for the current year, then the value displayed is zero.

B) If the engine modification incorporation rate, in events per 1000 engine flight hours, is less than or equal to the incorporation rate necessary to modify all engines available for modification for the current year, then the value displayed is the average number of flying engines that could be modified in the current year of the analysis minus the expected number of engines to be modified in the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

5. Critical Incorporation Rate (Events / 1000 EFH) (Column CD)

Column CD calculates the incorporation rate necessary to modify all engines available for modification for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CD$14, labeled CritIncorpRate, is

[Cell '3a 3b 4a 4b'!$CD$14 = IF(Cell 'Standard History'!H14 > 0, 2 / Cell 'Standard History'!H14 * 1000, 0)].

Cell 'Standard History'!$H$14 is labeled YrEfhPerEng and represents the average annual flight hours flown by each engine for the current year of the analysis.

The IF statement uses the following logic to determine the incorporation rate necessary to modify all engines available for modification for each year of the analysis:

A) If the average annual flight hours flown by each engine for the current year of the analysis is greater than zero, then the value displayed is two divided by the product of the average annual flight hours flown by each engine for the current year of the analysis and 1000.

B) If the average annual flight hours flown by each engine for the current year of the analysis is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

6. Years of Incorporation (Column CE)

Column CE determines in what years of the analysis kit installations are expected to occur. The formula in cell '3a 3b 4a 4b'!$CE$14, labeled YrsOfIncorp, is

[Cell '3a 3b 4a 4b'!$CE$14 = IF(CurYrProEngKitInstal = 0, 0, 1)].

This equals

[Cell '3a 3b 4a 4b'!$CE$14 = IF(Cell '3a 3b 4a 4b'!AZ14 = 0, 0, 1)].

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The IF statement uses the following logic to determine in what years kit installation occurs for the period of the analysis:

A) If the expected number of engines to be modified in the current year equals zero, then the value displayed is zero.

B) If the expected number of engines to be modified in the current year does not equal zero, then the value displayed is one.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$CE$60 calculates the total number of years kit installations are expected to occur over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$CE$60 = SUM(Cell '3a 3b 4a 4b'!CE14: Cell '3a 3b 4a 4b'!CE58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

7. Kit Incorporation Rates (Events / 1000 EFH) for Attrition & 1st Opportunity - Unsched (Column CF)

Column CF calculates the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by unscheduled maintenance for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CF$14, labeled UnschKitIncorpRate, is

[Cell '3a 3b 4a 4b'!$CF$14 = IF(OR(CurYrCurUnmodEfh < = 0, Cell 'Input'!$D$9 = 3), 0, 'Standard History'!D14 / 12 * Cell 'Input'!$D$25 * Cell 'Input'!$D$26)].

This equals

[Cell '3a 3b 4a 4b'!$CF$14 = IF(OR(Cell '3a 3b 4a 4b'!F14 < = 0, Cell 'Input'!$D$9 = 3), 0, 'Standard History'!D14 / 12 * Cell 'Input'!$D$25 * Cell 'Input'!$D$26)].

CurYrCurUnmodEfh is cell '3a 3b 4a 4b'!$F$14 and represents the expected number of engine flight hours for unmodified engines during the current year in thousands of hours.

Cell 'Input'!$D$9 is labeled IncorpStyle and determines how the change is incorporated.

Cell 'Standard History'!$D$14, labeled MoAvailFieldMod, represents the number of months during the current year that the modification will be incorporated into engines in the field.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$26 is labeled UnschEvtRateMod and represents an estimate of the rate at which an unscheduled maintenance event will occur that will provide an opportunity to incorporate the change. This is not necessarily the failure rate for the part, assembly, component, or module being replaced or modified.

The IF statement uses the following logic to determine the expected kit incorporation rate, in events per 1000 EFH, generated by unscheduled maintenance for each year of the analysis:

A) If the expected number of engine flight hours for unmodified engines during the current year in thousands of hours is less than or equal to zero or if the modification incorporation style is Forced Retrofit then the value displayed is zero.

B) If the expected number of engine flight hours for unmodified engines during the current year in thousands of hours is greater than zero and the modification incorporation style is not Forced Retrofit then the value displayed is the product of the number of months during the current year that the modification will be incorporated into engines in the field divided by 12, the percentage of unscheduled maintenance events during which modifications can be performed and the rate at which an unscheduled maintenance event will occur that will provide an opportunity to incorporate the change.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

8. Kit Incorporation Rates (Events / 1000 EFH) for Attrition & 1st Opportunity - Sched (Column CG)

Column CG calculates the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled maintenance for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CG$14, labeled SchedKitIncorpRate, is

[Cell '3a 3b 4a 4b'!$CG$14 = IF(OR(CurYrCurUnmodEfh < = 0, Cell 'Input'!$D$9 = 3), 0, 'Standard History'!D14 / 12 * Cell 'Input'!$D$24 * CurSchEvtunmod / CurYrCurUnmodEfh)].

This equals

[Cell '3a 3b 4a 4b'!$CF$14 = IF(OR(Cell '3a 3b 4a 4b'!F14 < = 0, Cell 'Input'!$D$9 = 3), 0, 'Standard History'!D14 / 12 * Cell 'Input'!$D$24 * Cell '3a 3b 4a 4b'!J14 / Cell '3a 3b 4a 4b'!F14)].

CurYrCurUnmodEfh is cell '3a 3b 4a 4b'!$F$14 and represents the expected number of engine flight hours of unmodified engines in thousands of hours for the current year.

Cell 'Input'!$D$9 is labeled IncorpStyle and determines how the change is incorporated.

Cell 'Standard History'!$D$14, labeled MoAvailFieldMod, represents the number of months during the current year that the modification will be incorporated into engines in the field.

Cell 'Input'!$D$24, labeled SchPctEvtMod, represents the percentage of scheduled maintenance events during which modifications can be performed.

CurSchEvtunmod is cell '3a 3b 4a 4b'!$J$14 and represents the number of scheduled maintenance events generated in the current year by the current engine configuration.

The IF statement uses the following logic to determine the expected kit incorporation rate, in events per 1000 EFH, generated by scheduled maintenance for each year of the analysis:

A) If the expected number of engine flight hours of unmodified engines in thousands of hours for the current year is less than or equal to zero or the modification incorporation style is Forced Retrofit then the value displayed is zero.

B) If the expected number of engine flight hours of unmodified engines in thousands of hours for the current year is greater than zero and the modification incorporation style is not Forced Retrofit then the value displayed is the product of the number of months during the current year that the modification will be incorporated into engines in the field divided by 12, the percentage of scheduled maintenance events during which modifications can be performed and the number of scheduled maintenance events generated in the current year by the current engine configuration divided by the expected number of engine flight hours of unmodified engines in thousands of hours for the current year.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

9. Kit Incorporation Rates (Events / 1000 EFH) for Attrition & 1st Opportunity - Total (Column CH)

Column CH calculates the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CH$14, labeled TotKitIncorpRate, is

[Cell '3a 3b 4a 4b'!$CH$14 = UnschKitIncorpRate + SchedKitIncorpRate].

This equals

[Cell '3a 3b 4a 4b'!$CH$14 = Cell '3a 3b 4a 4b'!CF14 + Cell '3a 3b 4a 4b'!CG14].

UnschKitIncorpRate is cell '3a 3b 4a 4b'!$CF$14 and represents the expected kit incorporation rate, in events per 1000 EFH, generated by unscheduled maintenance for the current year of the analysis.

SchedKitIncorpRate is cell '3a 3b 4a 4b'!$CG$14 and represents the expected kit incorporation rate, in events per 1000 EFH, generated by scheduled maintenance for the current year of the analysis.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

10. Kit Incorporation Events for Attr & 1st Opp - Unsched (Column CI)

Column CI calculates the expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CI$14, labeled UnschKitIncorpEvts, is

[Cell '3a 3b 4a 4b'!$CI$14 = IF(TotKitIncorpRate > 0, UnschKitIncorpRate / TotKitIncorpRate * CurYrProEngKitInstal, 0)].

This equals

[Cell '3a 3b 4a 4b'!$CI$14 = IF(Cell '3a 3b 4a 4b'!CH14 > 0, Cell '3a 3b 4a 4b'!CF14 / Cell '3a 3b 4a 4b'!CH14 * Cell '3a 3b 4a 4b'!AZ14, 0)].

TotKitIncorpRate is cell '3a 3b 4a 4b'!$CH$14 and represents the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis.

UnschKitIncorpRate is cell '3a 3b 4a 4b'!$CF$14 and represents the expected kit incorporation rate, in events per 1000 EFH, generated by unscheduled maintenance for the current year of the analysis.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The IF statement uses the following logic to determine the expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events for each year of the analysis:

A) If the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis is greater than zero, then the value displayed is the expected kit incorporation rate, in events per 1000 EFH, generated by unscheduled maintenance for the current year of the analysis divided by the product of the expected kit incorporation rate for Attrition and 1^{st} Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis and the expected number of engines to be modified in the current year.

B) If the expected kit incorporation rate for Attrition and 1^{st} Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$CI$60 calculates the total expected number of kit incorporation events, for Attrition and 1^{st} Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$CI$60 = SUM(Cell '3a 3b 4a 4b'!CI14:
Cell '3a 3b 4a 4b'!CI58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '3a 3b 4a 4b'!$CI$63 displays the expected amount of time allowed to accumulate on the current engine configuration before scheduled maintenance must be performed. The value is obtained from cell 'Input'!$E$32 labeled CurSchMaintInt.

Cell '3a 3b 4a 4b'!$CI$64 represents the calculated interval in EFH between maintenance inspections on unmodified engines. The cell formula is

[Cell '3a 3b 4a 4b'!$CI$64 = IF(Cell 'Input'!$E$33 > 0, 1000 / Cell 'Input'!$E$33 * 0.95, 9999999)].

Cell 'Input'!$E$33 is labeled CurCalSchMaintInt and represents the calculated scheduled maintenance interval rate per 1000 engine flight hours for the current engine configuration.

The IF statement uses the following logic to determine the calculated interval in EFH between maintenance inspections on unmodified engines:

A) If the calculated scheduled maintenance interval rate per 1000 engine flight hours for the current engine configuration is greater than zero, then the value displayed is 1000 divided by the product of the calculated scheduled maintenance interval rate per 1000 engine flight hours for the current engine configuration and 0.95.

B) If the calculated scheduled maintenance interval rate per 1000 engine flight hours for the current engine configuration is less than or equal to zero, then the value displayed is 9999999.

11. Kit Incorporation Events for Attr & 1st Opp - Sched (Column CJ)

Column CI calculates the expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events for each year of the analysis. The formula in cell '3a 3b 4a 4b'!$CJ$14, labeled SchedKitIncorpEvts, is

[Cell '3a 3b 4a 4b'!$CJ$14 = IF(TotKitIncorpRate > 0, SchedKitIncorpRate / TotKitIncorpRate * CurYrProEngKitInstal, 0)].

This equals

[Cell '3a 3b 4a 4b'!$CJ$14 = IF(Cell '3a 3b 4a 4b'!CH14 > 0, Cell '3a 3b 4a 4b'!CG14 / Cell '3a 3b 4a 4b'!CH14 * Cell '3a 3b 4a 4b'!AZ14, 0)].

TotKitIncorpRate is cell '3a 3b 4a 4b'!$CH$14 and represents the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis.

SchedKitIncorpRate is cell '3a 3b 4a 4b'!$CG$14 and represents the expected kit incorporation rate, in events per 1000 EFH, generated by scheduled maintenance for the current year of the analysis.

CurYrProEngKitInstal is cell '3a 3b 4a 4b'!$AZ$14 and represents the expected number of engines to be modified in the current year.

The IF statement uses the following logic to determine the expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events for each year of the analysis:

A) If the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis is greater than zero, then the value displayed is the expected kit incorporation rate, in events per 1000 EFH, generated by scheduled maintenance for the current year of the analysis divided by the product of the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis and the expected number of engines to be modified in the current year.

B) If the expected kit incorporation rate for Attrition and 1st Opportunity Incorporation Styles, in events per 1000 EFH, generated by scheduled and unscheduled maintenance for the current year of the analysis is less than or equal to zero, then the value displayed is zero.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '3a 3b 4a 4b'!$CJ$60 calculates the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis. The cell formula is

[Cell '3a 3b 4a 4b'!$CJ$60 = SUM(Cell '3a 3b 4a 4b'!CJ14:
Cell '3a 3b 4a 4b'!CJ58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

VI. DESCRIPTION OF THE PAGE 5 SHEET

A. INTRODUCTION

Page 5 of the model has its own worksheet identified by the worksheet tab labeled '5'. The page 5 sheet summarizes the cash flow for the current and proposed engine configurations, and also calculates the difference in life cycle cost between the two configurations and the net present value of that difference.

The page 5 sheet is made up of five columns, B through G. This chapter describes each of the columns and details the formulas and variables used within the columns.

B. CAL. YEAR - COLUMN B

Column B displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model. The reference in cell '5'!$B$14 is

[Cell '3a 3b 4a 4b'!$B$14 = Cell 'Standard History'!B14].

FirstYrStdHistory is cell 'Standard History'!$B$14 and represents the first year of the analysis. It is entered by the user in cell 32 of the applicable fleet in the Std_hist.xls file.

The cell references for the subsequent years are similar with the relative references in each cell increasing by one.

C. EXPENDITURES - COLUMNS C AND D

1. Current (Column C)

Column C displays, in thousands of dollars, the expected annual logistics support costs, including operational fuel, for the current engine configuration. The reference in cell '5'!$C$14, labeled CurExpenditures, is

[Cell '5'!$C$14 = Cell '3a 3b 4a 4b'!AL14].

Cell '3a 3b 4a 4b'!$AL$14 is labeled CurTotCst and represents the current engine configuration's expected logistics support costs, including operational fuel, for the current year of the analysis in thousands of dollars.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '5'!$C$60 calculates the total expected logistics support costs, including operational fuel, for the current engine configuration in thousands of dollars over the period of the analysis. The cell formula is

[Cell '5'!$C$60 = SUM(Cell '5'!C14: Cell '5'!C58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '5'!$C$62 calculates the net present value of the total expected logistics support costs, including operational fuel, for the current engine configuration in thousands of dollars over the period of the analysis. The cell formula is

[Cell '5'!$C$60 = NPV(Cell 'Input'!$G$9, Cell '5'!C14: Cell '5'!C58) * (1 + Cell 'Input'!$G$9)^(Cell 'Input'!$G$8 - Cell '5'!B14 + 1)].

Cell 'Input'!$G$9 is labeled NPVrate and represents the discount rate used in the net present value calculations in the model.

Cell '5'!$C$14 through cell '5'!$C$58 represent the expected annual logistics support costs, including operational fuel, for the current engine configuration for each year of the analysis.

Cell 'Input'!$G$8 is labeled YrDollar and represents the base year for the calculation of net present value in the model.

Cell '5'!$B$14 is the calendar year of the first year of the analysis.

NPV is an EXCEL worksheet function that returns the net present value of an investment based on a series of periodic cash flows and a discount rate. Net present value is the difference between the discounted present value of benefits and the discounted present value of costs.

Cell '5'!$C$64 displays the base year for the calculation of net present value in the model. The value is obtained from cell 'Input'!$G$8 labeled YrDollar.

Cell '5'!$C$65 displays the discount rate used in the net present value calculations in the model. The value is obtained from cell 'Input'!$G$9 labeled NPVrate.

2. Proposed (Column D)

Column D displays, in thousands of dollars, the expected annual logistics support costs, including operational fuel and aircraft loss, for the proposed engine configuration. The formula in cell '5'!$D$14, labeled ProExpenditures, is

[Cell '5'!$D$14 = Cell '3a 3b 4a 4b'!BX14].

TotCurCostPlusACLoss is cell '3a 3b 4a 4b'!BX and represents the current year's expected logistics support costs, in thousands of dollars, for the proposed engine configuration, including operational fuel and A/C loss.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '5'!$D$60 calculates the total expected logistics support costs, including operational fuel and aircraft loss, for the proposed engine configuration in thousands of dollars, over the period of the analysis. The cell formula is

[Cell '5'!$D$60 = SUM(Cell '5'!D14: Cell '5'!D58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '5'!$D$62 calculates the net present value of the total expected logistics support costs, including operational fuel and aircraft loss, for the proposed engine configuration in thousands of dollars over the period of the analysis. The cell formula is

[Cell '5'!$D$62 = NPV(Cell 'Input'!$G$9, Cell '5'!D14: Cell '5'!D58) * (1 + Cell 'Input'!$G$9)^(Cell 'Input'!$G$8 - Cell '5'!B14 + 1)].

Cell 'Input'!$G$9 is labeled NPVrate and represents the discount rate used in the net present value calculations in the model.

Cell '5'!$D$14 through cell '5'!$D$58 represent the expected annual logistics support costs, including operational fuel and aircraft loss, for the proposed engine configuration for each year of the analysis.

Cell 'Input'!$G$8 is labeled YrDollar and represents the base year for the calculation of net present value in the model.

Cell '5'!$B$14 is the calendar year of the first year of the analysis.

NPV is an EXCEL worksheet function that returns the net present value of an investment based on a series of periodic cash flows and a discount rate. Net present value is the difference between the discounted present value of benefits and the discounted present value of costs.

D. DELTA CASHFLOW - COLUMNS E AND F

1. Yearly Savings (Column E)

Column E calculates the expected annual savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars. The formula in cell '5'!$E$14, labeled CurYrDeltaCashYrSav, is

[Cell '5'!$E$14 = + CurExpenditures - ProExpenditures].

This equals

[Cell '5'!$E$14 = + Cell '5'!C14 - Cell '5'!D14].

CurExpenditures is cell '5'!$C$14 and represents the expected current year logistics support costs, including operational fuel, for the current engine configuration in thousands of dollars.

ProExpenditures is cell '5'!$D$14 and represents the expected current year logistics support costs, including operational fuel and aircraft loss, for the proposed engine configuration in thousands of dollars.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

Cell '5'!$E$60 calculates the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis. The cell formula is

[Cell '5'!$E$60 = SUM(Cell '5'!E14: Cell '5'!E58)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell '5'!$E$62 calculates the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis. The cell formula is

[Cell '5'!$E$62 = NPV(Cell 'Input'!$G$9, Cell '5'!E14: Cell '5'!E58) * (1 + Cell 'Input'!$G$9)^(Cell 'Input'!$G$8 - Cell '5'!B14 + 1)].

Cell 'Input'!$G$9 is labeled NPVrate and represents the discount rate used in the net present value calculations in the model.

Cell '5'!$E$14 through cell '5'!$E$58 represent the expected annual savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars.

Cell 'Input'!$G$8 is labeled YrDollar and represents the base year for the calculation of net present value in the model.

Cell '5'!$B$14 is the calendar year of the first year of the analysis.

NPV is an EXCEL worksheet function that returns the net present value of an investment based on a series of periodic cash flows and a discount rate. Net present value is the difference between the discounted present value of benefits and the discounted present value of costs.

2. Cumulative Savings (Column F)

Column F calculates the expected cumulative savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars. The formula in cell '5'!$F$14 is

[Cell '5'!$F$14 = + CurYrDeltaCashYrSav - PrevYrDeltaCashCumSav].

This equals

[Cell '5'!$F$14 = + Cell '5'!E14 - Cell '5'!F13].

CurYrDeltaCashYrSav is cell '5'!$E$14 and represents the expected savings of the proposed engine configuration over the current engine configuration for the current year of the analysis.

Cell '5'!$F$13 labeled PrevYrDeltaCashCumSav is zero and merely serves as a placeholder to begin column F calculations. In this context it represents the cumulative savings accumulated through the prior year of the analysis.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

E. CUMULATIVE NPV AT XX % - COLUMN G

Column G calculates the net present value of the expected annual savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars. The formula in cell '5'!$G$14 is

[Cell '5'!$G$14 = NPV(Cell 'Input'!$G$9, Cell '5'!E$14: Cell '5'!E14) * (1 + Cell 'Input'!$G$9)^(Cell 'Input'!$G$8 - Cell '5'!B14 + 1)].

Cell 'Input'!$G$9 is labeled NPVrate and represents the discount rate used in the net present value calculations in the model.

Cell '5'!$E$14 is labeled CurYrDeltaCashYrSav and represents the expected annual savings of the proposed engine configuration over the current engine configuration for the current year of the analysis.

Cell 'Input'!$G$8 is labeled YrDollar and represents the base year for the calculation of net present value in the model.

Cell '5'!$B$14 is the calendar year of the first year of the analysis.

NPV is an EXCEL worksheet function that returns the net present value of an investment based on a series of periodic cash flows and a discount rate. Net present value is the difference between the discounted present value of benefits and the discounted present value of costs.

Cell '5'!$E$11 represents the discount rate used in the net present value calculations in the model and is obtained from cell 'Input'!$G$9 labeled NPVrate.

The cell formulas for the subsequent years are similar with the relative references in each cell increasing by one.

VII. DESCRIPTION OF THE INTERIM CALCULATIONS SHEET

A. INTRODUCTION

The Interim Calculations sheet contains page 6 of the model and is identified by the worksheet tab labeled 'Interim'. The Interim Calculations sheet provides a collection of intermediate solutions that can be used to compare the current and proposed engine configurations and the equations used to determine the ten summary costs and savings values on the Summary page.

The Interim Calculations sheet is broken into six sections. The first five sections use letters to label values that will be used in section six, the Summary Page Equations. These "lettered values" are referred to as a "Line" in the section descriptions in this chapter.

Beginning with column H of sections three and four, a description is provided of how each cost is calculated with reference to the applicable line numbers from the Input Sheet.

This chapter describes each of the six sections and also describes the formulas and variables used in all calculations and equations on the page.

B. SUMMARY PAGE EQUATION INPUT PARAMETERS (LINE A THROUGH F)

1. Delta Production Cost (Line A)

Delta Production Cost is cell 'Interim'!$D$9 and displays the expected difference in the price of the production engine due to the change. The value is obtained from cell 'Input'!$D$15 labeled DeltaProdCost.

2. Kit Cost (Line B)

Kit Cost is cell 'Interim'!$D$10 and is labeled Kit_Cost. Kit_Cost represents the expected material cost of the kit. If the change does not use a kit, Kit_Cost is the cost of the upgraded parts. The value is obtained from cell 'Input'!$D$16 labeled KitCost.

3. Labor Cost to Install the Kit (Line C)

Labor Cost to Install the Kit is cell 'Interim'!$D$11, labeled KitLaborCost, and represents the total expected cost of labor per engine modification. The cell formula is

[Cell 'Interim'!$D$11 = (Cell 'Input'!$D$17 * Cell 'Input'!$G$11) + (Cell 'Input'!$D$18 * Cell 'Input'!$G$12)].

Cell 'Input'!$D$17 is labeled KitLaborOI and represents the base level man-hours required to install the kit at the Organizational or Intermediate level.

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Cell 'Input'!$D$18 is labeled KitLaborDepot and represents the base level man-hours required to install the kit at the Depot level.

Cell 'Input'!$G$12 is labeled LaborCostDepot and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

4. Publications Cost (Line D)

Publications Cost is cell 'Interim'!$H$9 and represents the total expected cost of publishing technical manuals and technical orders and directives required by the change. The cell formula is

[Cell 'Interim'!$H$9 = Cell 'Input'!$D$19 + Cell 'Input'!$D$20].

Cell 'Input'!$D$19 is labeled TechPubsCost and represents the total cost of the modification or creation of technical publications due to the change.

Cell 'Input'!$D$20 is labeled TctoCost and represents the total cost, in dollars, to produce a Time Compliance Technical Order or Technical Directive if required by the change.

5. Support Equipment (Line E)

Support Equipment is cell 'Interim'!$H$10 and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification. The value is obtained from cell 'Input'!$D$21 labeled ToolSE.Cost.

The costs to modify current tooling and support equipment necessary to carry out the engineering change proposal are also included in this cost. (Davis, 1991, p. 28)

6. Aircraft Cost (Line F)

Aircraft Cost is cell 'Interim'!$H$11 and represents the cost, in fiscal year dollars, of the aircraft in which the modification is being done. The value is obtained from cell 'Input'!$G$26.

C. MODIFICATION EVENTS (LINE G AND H)

1. Engines Modified in Production - Total (Line G)

Engines Modified in Production - Total is cell 'Interim'!$H$14 and represents the total number of engines modified during production over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AO$60 labeled TotEngModProd.

2. Retrofit Events (Line H)

a. Unscheduled

Retrofit Events - Unscheduled is cell 'Interim'!$D$15 and represents the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$CI$60.

b. Scheduled

Retrofit Events - Scheduled is cell 'Interim'!$E$15 and represents the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$CJ$60.

c. Spares

Retrofit Events - Spares is cell 'Interim'!$F$15 and represents the total expected number of spare engines to be modified over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$BC$60.

d. Total

Retrofit Events - Total is cell 'Interim'!$H$15 and represents the total expected number of engines to be modified over the period of the analysis. The cell formula is
[Cell 'Interim'!$H$15 = Cell '3a 3b 4a 4b'!$AZ$60 + Cell '3a 3b 4a 4b'!$BC$60].

Cell '3a 3b 4a 4b'!$AZ$60 represents the total expected number of operational engines to be modified over the period of the analysis.

Cell '3a 3b 4a 4b'!$BC$60 represents the total expected number of spare engines to be modified over the period of the analysis.

C. OPERATIONAL EVENTS & EFH (LINE J THROUGH M)

1. Scheduled Events (Line J)

a. Current

Scheduled Events - Current is cell 'Interim'!$D$19 and represents the expected number of scheduled maintenance events generated annually by the current engine configuration. The value is obtained from cell '3a 3b 4a 4b'!$J$60.

b. Proposed - Unmod

Scheduled Events - Proposed - Unmod is cell 'Interim'!$E$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AV$60.

c. Proposed - Mod

Scheduled Events - Proposed - Mod is cell 'Interim'!$F$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AW$60.

2. Unscheduled Events (Line K)

a. Current

Unscheduled Events - Current is cell 'Interim'!$D$20 and represents the total expected number of unscheduled maintenance events generated by the current engine configuration over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$H$60.

b. Proposed - Unmod

Unscheduled Events - Proposed - Unmod is cell 'Interim'!$E$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AT$60.

c. Proposed - Mod

Unscheduled Events - Proposed - Mod is cell 'Interim'!$F$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AU$60.

3. Engine Flight Hours (In thousands) (Line L)

a. Current

Engine Flight Hours - Current is cell 'Interim'!$D$21 and represents the total expected number of current configuration engine flight hours flown over the period of the analysis in thousands of hours. The value is obtained from cell '3a 3b 4a 4b'!$F$60.

b. Proposed - Unmod

Engine Flight Hours - Proposed - Unmod is cell 'Interim'!$E$21 and represents the total expected number of engine flight hours, in thousands of hours, logged by unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AR$60.

c. Proposed - Mod

Engine Flight Hours - Proposed - Mod is cell 'Interim'!$F$21 and represents the total expected number of engine flight hours, in thousands of hours, logged by modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AS$60.

4. Aircraft Losses Delta (Line M)

Aircraft Losses Delta is cell 'Interim'!$F$22 and represents the change in the total number of aircraft expected to be lost due to a failure of the component being modified over the period of the analysis as a result of the modification program. The value is obtained from cell '3a 3b 4a 4b'!$AY$60.

D. SCHEDULED COSTS / EVENT (LINE N THROUGH Q)

1. O & I Labor

a. Current

O & I Labor - Current is cell 'Interim'!$D$26 and is labeled CurSchOILaborCost_Evt. CurSchOILaborCost_Evt represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$26 = Cell 'Input'!$G$11 * (((Cell 'Input'!$E$37 + Cell 'Input'!$E$36) * Cell 'Input'!$E$35) + Cell 'Input'!$E$34)].

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the

Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Cell 'Input'!$E$37 is labeled CurSchMhIlev and represents the estimate of the number of manhours required to complete any scheduled maintenance on the component being modified at the Intermediate level.

Cell 'Input'!$E$36 is labeled CurSchMhRrOLev and represents the number of manhours that are estimated to be necessary to remove or replace the component being modified during scheduled maintenance at the Organizational level.

Cell 'Input'!$E$35 is labeled CurSchPctRemOILev and represents the percentage of time a scheduled event will require either removal or replacement of the engine component being modified at the Organizational or Intermediate level.

Cell 'Input'!$E$34 is labeled CurSchMhInspOlev and represents the estimate of the number of hours required to inspect the engine, related to the change, during scheduled maintenance at the Organizational level.

b. Proposed - Unmod

O & I Labor - Proposed - Unmod is cell 'Interim'!$E$26 and is labeled CurSchOILaborCost_Evt. CurSchOILaborCost_Evt represents the expected cost of labor, per scheduled maintenance event, for maintenance on the unmodified proposed engine configuration at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$D$26 labeled CurSchOILaborCost_Evt.

c. *Proposed - Mod*

O & I Labor - Proposed - Mod is cell 'Interim'!$F$26 and is labeled ProSchOILaborCost_Evt. ProSchOILaborCost_Evt represents the expected cost of labor, per scheduled maintenance event, for maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$F$26 = Cell 'Input'!$G$11 * (((Cell 'Input'!$F$36 + Cell 'Input'!$F$37) * Cell 'Input'!$F$35) + Cell 'Input'!$F$34)].

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Cell 'Input'!$F$36 is labeled ProSchMhRrOLev and represents the number of manhours that are estimated to be necessary to remove or replace the component being modified during scheduled maintenance at the Organizational level.

Cell 'Input'!$F$37 is labeled ProSchMhIlev and represents the estimate of the number of manhours required to complete any scheduled maintenance on the component being modified at the Intermediate level.

Cell 'Input'!$F$35 is labeled ProSchPctRemOILev represents the percentage of time a scheduled event will require either removal or replacement of the engine component being modified at the Organizational or Intermediate level.

Cell 'Input'!$F$34 is labeled ProSchMhInspOlev and is the estimate of the number of hours required to inspect the engine, related to the change, during scheduled maintenance at the Organizational level.

2. Depot Labor

a. Current

Depot Labor - Current is cell 'Interim'!$D$27 and is labeled CurSchDepLaborCost_Evt. CurSchDepLaborCost_Evt represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$D$27 = Cell 'Input'!$E$40 * Cell 'Input'!$E$41 * Cell 'Input'!$G$12].

Cell 'Input'!$E$40 is labeled CurSchPctRetDepot and is the estimate of the percentage of components that require scheduled maintenance that cannot be performed at the Depot level.

Cell 'Input'!$E$41, labeled CurSchMhDepot, represents the manhours required to complete a scheduled maintenance event on the component at the Depot level.

Cell 'Input'!$G$12 is labeled LaborCostDepot and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

b. Proposed - Unmod

Depot Labor - Proposed - Unmod is cell 'Interim'!$E$27 and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the unmodified proposed engine configuration at the Depot level. The value is obtained from cell 'Interim'!$D$27 labeled CurSchDepLaborCost_Evt.

c. Proposed - Mod

Depot Labor - Proposed - Mod is cell 'Interim'!$F$27 and is labeled ProSchDepLaborCost_Evt. ProSchDepLaborCost_Evt represents the expected cost of labor, per scheduled maintenance event, for maintenance on the modified proposed engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$F$27 = Cell 'Input'!$F$40 * Cell 'Input'!$F$41 * Cell 'Input'!$G$12].

Cell 'Input'!$F$40 is labeled ProSchPctRetDepot and is the estimate of the percentage of components that require scheduled maintenance that cannot be performed at the Depot level.

Cell 'Input'!$F$41, labeled ProSchMhDepot, represents the manhours required to complete a scheduled maintenance event on the component at the Depot level.

Cell 'Input'!$G$12 is labeled LaborCostDepot and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

3. Total Labor (Line N)

a. Current

Total Labor - Current is cell 'Interim'!$D$28 and is labeled CurSchTotLaborCost_Evt. CurSchTotLaborCost_Evt represents the total expected cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events. The cell formula is

[Cell 'Interim'!$D$28 = CurSchOILaborCost_Evt + CurSchDepLaborCost_Evt].

This equals

[Cell 'Interim'!$D$28 = Cell 'Interim'!$D$26 + Cell 'Interim'!$D$27].

CurSchOILaborCost_Evt is cell 'Interim'!$D$26 and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels.

CurSchDepLaborCost_Evt is cell 'Interim'!$D$27 and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the current engine configuration at the Depot level.

b. Proposed - Unmod

Total Labor - Proposed - Unmod is cell 'Interim'!$E$28 and represents the total expected cost of labor for maintenance on the unmodified proposed engine configuration generated by scheduled maintenance events. The value is obtained from cell 'Interim'!$D$28 labeled CurSchTotLaborCost_Evt.

c. Proposed - Mod

Total Labor - Proposed - Mod is cell 'Interim'!$F$28 and is labeled ProSchTotLaborCost_Evt. ProSchTotLaborCost_Evt represents the total expected cost of labor for maintenance on the modified proposed engine configuration generated by scheduled maintenance events. The cell formula is

[Cell 'Interim'!$E$28 = ProSchOILaborCost_Evt + ProSchDepLaborCost_Evt].

This equals

[Cell 'Interim'!$E$28 = Cell 'Interim'!$F$26 + Cell 'Interim'!$F$27].

ProSchOILaborCost_Evt is cell 'Interim'!$F$26 and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels.

ProSchDepLaborCost_Evt is cell 'Interim'!$F$27 and represents the expected cost of labor, per scheduled maintenance event, for maintenance on the modified proposed engine configuration at the Depot level.

4. O & I Repair

a. Current

O & I Repair - Current is cell 'Interim'!$D$30 and is labeled CurSchOIRepCost_Evt. CurSchOIRepCost_Evt represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$30 = Cell 'Input'!$E$38 * Cell 'Input'!$E$39].

Cell 'Input'!$E$38 is labeled CurSchPctRepOIlev and represents the percentage of time a scheduled maintenance event will require material cost at the Organizational and Intermediate levels.

Cell 'Input'!$E$39 is labeled CurSchRepOIlevCost and represents the expected cost of scheduled maintenance at the Organizational and Intermediate levels.

b. Proposed - Unmod

O & I Repair - Proposed - Unmod is cell 'Interim'!$E$30 and represents the expected cost of materials during scheduled maintenance on the unmodified proposed engine configuration at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$D$30 labeled CurSchOIRepCost_Evt.

c. Proposed - Mod

O & I Repair - Proposed - Mod is cell 'Interim'!$F$30 and is labeled ProSchOIRepCost_Evt. ProSchOIRepCost_Evt represents the expected cost of materials during scheduled maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels. The cell formula is
[Cell 'Interim'!$F$30 = Cell 'Input'!$F$38 * Cell 'Input'!$F$39].

Cell 'Input'!$F$38 is labeled ProSchPctRepOIlev and represents the percentage of time a scheduled maintenance event will require material cost at the Organizational and Intermediate levels.

Cell 'Input'!$F$39 is labeled ProSchRepOIlevCost and represents the expected cost of scheduled maintenance at the Organizational and Intermediate levels.

5. Depot Repair

a. Current

Depot Repair - Current is cell 'Interim'!$D$31 and is labeled CurSchDepRepCost_Evt. CurSchDepRepCost_Evt represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$D$31 = Cell 'Input'!$E$42 * Cell 'Input'!$E$43].

Cell 'Input'!$E$42 is labeled CurSchPctDepotRep and represents the percentage of time a scheduled event will require material cost at the Depot level.

Cell 'Input'!$E$43 is labeled CurSchRepDepotCost and represents the material cost of a scheduled event on the component at the Depot level.

b. Proposed - Unmod

Depot Repair - Proposed - Unmod is cell 'Interim'!$E$31 and represents the expected cost of materials during scheduled maintenance on the unmodified proposed engine configuration at the Depot level. The value is obtained from cell 'Interim'!$D$31 labeled CurSchDepRepCost_Evt.

c. Proposed - Mod

Depot Repair - Proposed - Mod is cell 'Interim'!$F$31 and represents the expected cost of materials during scheduled maintenance on the modified proposed engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$F$31 = Cell 'Input'!$F$42 * Cell 'Input'!$F$43].

Cell 'Input'!$F$42 is labeled ProSchPctDepotRep and represents the percentage of time a scheduled event will require material cost at the Depot level.

Cell 'Input'!$F$43 is labeled ProSchRepDepotCost and represents the material cost of a scheduled event on the component at the Depot level.

6. Scrap Cost

a. Current

Scrap Cost - Current is cell 'Interim'!$D$32 and is labeled CurSchScrapCost_Evt. CurSchScrapCost_Evt represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the current engine configuration. The cell formula is

[Cell 'Interim'!$D$32 = Cell 'Input'!$E$44 * Cell 'Input'!$E$45].

Cell 'Input'!$E$44 is labeled CurSchPctScrap and is the estimate of the percentage of time the component will be scrapped during a scheduled event.

Cell 'Input'!$E$45 is labeled CurSchPartScpCost and represents the replacement cost of scrapping a component required by scheduled maintenance. The replacement component is assumed to be a new unit purchased for that purpose.

b. Proposed - Unmod

Scrap Cost - Proposed - Unmod is cell 'Interim'!$E$32 and represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$32 labeled CurSchScrapCost_Evt.

c. Proposed - Mod

Scrap Cost - Proposed - Mod is cell 'Interim'!$F$32 and is labeled ProSchScrapCost_Evt. ProSchScrapCost_Evt represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the modified proposed engine configuration. The cell formula is [Cell 'Interim'!$F$32 = Cell 'Input'!$F$44 * Cell 'Input'!$F$45].

Cell 'Input'!$F$44 is labeled ProSchPctScrap and is the estimate of the percentage of time the component will be scrapped during a scheduled event.

Cell 'Input'!$F$45 is labeled ProSchPartScpCost and represents the replacement cost of scrapping a component required by scheduled maintenance. The replacement component is assumed to be a new unit purchased for that purpose.

7. Total Material (Line P)

a. Current

Total Material - Current is cell 'Interim'!$D$33 and is labeled CurSchTotMatCost_Evt. CurSchTotMatCost_Evt represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified. The cell formula is

[Cell 'Interim'!$D$33 = CurSchOIRepCost_Evt + CurSchDepRepCost_Evt + CurSchScrapCost_Evt].

This equals

[Cell 'Interim'!$D$33 = Cell 'Interim'!$D$30 + Cell 'Interim'!$D$31 + Cell 'Interim'!$D$32].

CurSchOIRepCost_Evt is cell 'Interim'!$D$30 and represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Organizational and Intermediate levels.

CurSchDepRepCost_Evt is cell 'Interim'!$D$31 and represents the expected cost of materials during scheduled maintenance on the current engine configuration at the Depot level.

CurSchScrapCost_Evt is cell 'Interim'!$D$32 and represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the current engine configuration.

b. Proposed - Unmod

Total Material - Proposed - Unmod is cell 'Interim'!$E$33 and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the unmodified proposed engine configuration and if required, the cost of replacing the component being modified. The value is obtained from cell 'Interim'!$D$33 labeled CurSchTotMatCost_Evt.

c. Proposed - Mod

Total Material - Proposed - Mod is cell 'Interim'!$F$33 and is labeled ProSchTotMatCost_Evt. ProSchTotMatCost_Evt represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the modified proposed engine configuration and, if required, the cost of replacing the component being modified. The cell formula is

[Cell 'Interim'!$F$33 = ProSchOIRepCost_Evt + ProSchDepRepCost_Evt + ProSchScrapCost_Evt].

This equals

[Cell 'Interim'!$F$33 = Cell 'Interim'!$F$30 + Cell 'Interim'!$F$31 + Cell 'Interim'!$F$32].

ProSchOIRepCost_Evt is cell 'Interim'!$F$30 and represents the expected cost of materials during scheduled maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

ProSchDepRepCost_Evt is cell 'Interim'!$F$31 and represents the expected cost of materials during scheduled maintenance on the proposed engine configuration at the Depot level.

ProSchScrapCost_Evt is cell 'Interim'!$F$32 and represents the expected material cost of replacing the component to be modified, if required, during scheduled maintenance on the proposed engine configuration.

8. Test Labor & Fuel

a. Current

Test Labor & Fuel - Current is cell 'Interim'!$D$35 and is labeled CurSchTestLabFuelCost_Evt. CurSchTestLabFuelCost_Evt represents the expected cost of labor and fuel used to test the current engine configuration after scheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$35 = Cell 'Standard History'!$G$62 * Cell 'Input'!$G$17 * Cell 'Input'!$E$46 + 2 * Cell 'Input'!$G$11 * Cell 'Input'!$E$46].

Cell 'Standard History'!$G$62 is labeled TestFuelGH and represents the fuel consumption rate during engine testing. TestFuelGH is based on the gallons of fuel used per hour of testing, not necessarily engine run time. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon. To change FuelCostGal, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 17.

Cell 'Input'!$E$46 is labeled CurSchEngTstTime and represents the expected number of hours needed to test the engine after scheduled maintenance. This assumes there are two base level manhours per test hour for labor costs.

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

b. Proposed - Unmod

Test Labor & Fuel - Proposed - Unmod is cell 'Interim'!$E$35 and represents the expected cost of labor and fuel used to test the unmodified proposed engine configuration after scheduled maintenance at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$D$35 labeled CurSchTestLabFuelCost_Evt.

c. Proposed - Mod

Test Labor & Fuel - Proposed - Mod is cell 'Interim'!$F$35 and is labeled ProSchTestLabFuelCost_Evt. ProSchTestLabFuelCost_Evt represents the expected cost of labor and fuel used to test the modified proposed engine configuration after scheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$F$35 = Cell 'Standard History'!$G$62 * Cell 'Input'!$G$17 * Cell 'Input'!$F$46 + 2 * Cell 'Input'!$G$11 * Cell 'Input'!$F$46].

Cell 'Standard History'!$G$62 is labeled TestFuelGH and represents the fuel consumption rate during engine testing. TestFuelGH is based on the gallons of fuel used per hour of testing, not necessarily engine run time. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon. To change FuelCostGal, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 17.

Cell 'Input'!$F$46 is labeled ProSchEngTstTime and represents the expected number of hours needed to test the engine after scheduled maintenance. This assumes there are two base level manhours per test hour for labor costs.

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

9. Total Material Incl Test (Line Q)

a. *Current*

Test Material Incl Test - Current is cell 'Interim'!$D$36 and is labeled CurTotMatCostSch. CurTotMatCostSch represents the total expected cost of materials per scheduled maintenance event on the current engine configuration. The cell formula is

[Cell 'Interim'!$D$36 = CurSchTotMatCost_Evt + CurSchTestLabFuelCost_Evt].

This equals

[Cell 'Interim'!$D$36 = Cell 'Interim'!$D$33 + Cell 'Interim'!$D$35].

CurSchTotMatCost_Evt is cell 'Interim'!$D$33 and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified.

CurSchTestLabFuelCost_Evt is cell 'Interim'!$D$35 and represents the expected cost of labor and fuel used to test the current engine configuration after scheduled maintenance at the Organizational and Intermediate levels.

b. Proposed - Unmod

Test Material Incl Test - Proposed - Unmod is cell 'Interim'!$E$36 and represents the total expected cost of materials per scheduled maintenance event on the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$36 labeled CurTotMatCostSch.

c. Proposed - Mod

Test Material Incl Test - Proposed - Mod is cell 'Interim'!$F$36 and is labeled ProTotMatCostSch. ProTotMatCostSch represents the total expected cost of materials per scheduled maintenance event on the modified proposed engine configuration. The cell formula is

[Cell 'Interim'!$F$36 = ProSchTotMatCost_Evt + ProSchTestLabFuelCost_Evt].

This equals

[Cell 'Interim'!$F$36 = Cell 'Interim'!$F$33 + Cell 'Interim'!$F$35].

ProSchTotMatCost_Evt is cell 'Interim'!$F$33 and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the modified proposed engine configuration and if required, the cost of replacing the component being modified.

ProSchTestLabFuelCost_Evt is cell 'Interim'!$F$35 and represents the expected cost of labor and fuel used to test the modified proposed engine configuration after scheduled maintenance at the Organizational and Intermediate levels.

E. UNSCHEDULED COSTS / EVENT (LINE R THROUGH U)

1. O & I Labor

a. Current

O & I Labor - Current is cell 'Interim'!$D$40, is labeled CurUnschOILaborCost_Evt and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$40 = Cell 'Input'!$G$11 * (((Cell 'Input'!$E$51 + Cell 'Input'!$E$52) * Cell 'Input'!$E$50) + Cell 'Input'!$E$49)].

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Cell 'Input'!$E$51 is labeled CurUnschMhRrOlev and represents the number of man-hours expected to remove and replace the component when required during an unscheduled event at the Organizational level.

Cell 'Input'!$E$52 is labeled CurUnschMhIlev and represents the number of man-hours required to repair the modified component at the Intermediate level during unscheduled maintenance.

Cell 'Input'!$E$50 is labeled CurUnschPctRemOILev and is the users estimate of the percentage of time an unscheduled maintenance event will require the removal and replacement of the component being modified at the Organizational and Intermediate levels.

Cell 'Input'!$E$49 is labeled CurUnschMhOlev and represents the number of man-hours required to inspect the component associated with an unscheduled maintenance event at the Organizational level.

b. Proposed - Unmod

O & I Labor - Proposed - Unmod is cell 'Interim'!$E$40 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the unmodified proposed engine configuration at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$D$40 labeled CurUnschOILaborCost_Evt.

c. Proposed - Mod

O & I Labor - Proposed - Mod is cell 'Interim'!$F$40 and is labeled ProUnschOILaborCost_Evt. ProUnschOILaborCost_Evt represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$F$40 = Cell 'Input'!$G$11 * (((Cell 'Input'!$F$51 + Cell 'Input'!$F$52) * Cell 'Input'!$F$50) + Cell 'Input'!$F$49)].

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

Cell 'Input'!$F$51 is labeled ProUnschMhRrOlev and represents the number of man-hours expected to remove and replace the component when required during an unscheduled event at the Organizational level.

Cell 'Input'!$F$52 is labeled ProUnschMhIlev and represents the number of man-hours required to repair the modified component at the Intermediate level during unscheduled maintenance.

Cell 'Input'!$F$50 is labeled ProUnschPctRemOILev and is the users estimate of the percentage of time an unscheduled maintenance event will require the removal and replacement of the component being modified at the Organizational and Intermediate levels.

Cell 'Input'!$F$49 is labeled ProUnschMhOlev and represents the number of man-hours required to inspect the component associated with an unscheduled maintenance event at the Organizational level.

2. Depot Labor

a. Current

Depot Labor - Current is cell 'Interim'!$D$41 and is labeled CurUnschDepLaborCost_Evt. CurUnschDepLaborCost_Evt represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$D$41 = Cell 'Input'!$E$55 * Cell 'Input'!$E$56 * Cell 'Input'!$G$12].

Cell 'Input'!$E$55 is labeled CurUnschPctRetDepot and represents the percentage of components that require maintenance during an unscheduled event that can not be performed at the Organizational or Intermediate levels.

Cell 'Input'!$E$56 is labeled CurUnschMhDepot and represents the number of manhours required for unscheduled maintenance of a component at the Depot level.

Cell 'Input'!$G$12 is labeled LaborCostDepot and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

b. Proposed - Unmod

Depot Labor - Proposed - Unmod is cell 'Interim'!$E$41 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the unmodified proposed engine configuration at the Depot level. The value is obtained from cell 'Interim'!$D$41 labeled CurUnschDepLaborCost_Evt.

c. Proposed - Mod

Depot Labor - Proposed - Mod is cell 'Interim'!$F$41 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the modified proposed engine configuration at the Depot level. The cell formula is [Cell 'Interim'!$F$41 = Cell 'Input'!$F$55 * Cell 'Input'!$F$56 * Cell 'Input'!$G$12].

Cell 'Input'!$F$55 is labeled ProUnschPctRetDepot and represents the percentage of components that require maintenance during an unscheduled event that can not be performed at the Organizational or Intermediate levels.

Cell 'Input'!$F$56 is labeled ProUnschMhDepot and represents the number of manhours required for unscheduled maintenance of a component at the Depot level.

Cell 'Input'!$G$12 is labeled LaborCostDepot and represents the Depot level labor rate in dollars per man-hour. To change LaborCostDepot, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 12.

3. Total Labor (Line R)

a. Current

Total Labor - Current is cell 'Interim'!$D$42 and is labeled CurUnschTotLaborCost_Evt. CurUnschTotLaborCost_Evt represents the total expected cost of labor for maintenance on the current engine configuration generated by unscheduled maintenance events. The cell formula is [Cell 'Interim'!$D$42 = CurUnschOILaborCost_Evt + CurUnschDepLaborCost_Evt].

This equals

[Cell 'Interim'!$D$42 = Cell 'Interim'!$D$40 + cell 'Interim'!$D$41].

CurUnschOILaborCost_Evt is cell 'Interim'!$D$40 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Organizational and Intermediate levels.

CurUnschDepLaborCost_Evt is cell 'Interim'!$D$41 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the current engine configuration at the Depot level.

b. Proposed - Unmod

Total Labor - Proposed - Unmod is cell 'Interim'!$E$42 and represents the total expected cost of labor for maintenance on the unmodified proposed engine configuration generated by unscheduled maintenance events. The value is obtained from cell 'Interim'!$D$42 labeled CurUnschTotLaborCost_Evt.

c. Proposed - Mod

Total Labor - Proposed - Mod is cell 'Interim'!$F$42 and is labeled ProUnschTotLaborCost_Evt. ProUnschTotLaborCost_Evt represents the total expected cost of labor for maintenance on the modified proposed engine configuration generated by unscheduled maintenance events. The cell formula is

[Cell 'Interim'!$F$42 = ProUnschOILaborCost_Evt + ProUnschDepLaborCost_Evt].

This equals

[Cell 'Interim'!$F$42 = Cell 'Interim'!$F$40 + cell 'Interim'!$F$41].

ProUnschOILaborCost_Evt is cell 'Interim'!$F$40 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the proposed engine configuration at the Organizational and Intermediate levels.

ProUnschDepLaborCost_Evt is cell 'Interim'!$F$41 and represents the expected cost of labor, per unscheduled maintenance event, for maintenance on the proposed engine configuration at the Depot level.

4. O & I Repair

a. Current

O & I Repair - Current is cell 'Interim'!$D$44 and is labeled CurUnschOIRepCost_Evt. CurUnschOIRepCost_Evt represents the expected cost of materials during unscheduled maintenance on the current engine configuration at the Organizational and Intermediate levels. The cell formula is
[Cell 'Interim'!$D$44 = Cell 'Input'!$E$53 * Cell 'Input'!$E$54].

Cell 'Input'!$E$53 is labeled CurUnschPctRepOIlev and represents the percentage of time an unscheduled maintenance event will require material cost at the Organizational and Intermediate levels.

Cell 'Input'!$E$54 is labeled CurUnschRepOIlevCost and represents the cost of materials required for an unscheduled maintenance event at the Organizational and Intermediate levels.

b. Proposed - Unmod

O & I Repair - Proposed - Unmod is cell 'Interim'!$E$44 and represents the expected cost of materials during unscheduled maintenance on the unmodified proposed engine configuration at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$E$44 and CurUnschOIRepCost_Evt.

c. Proposed - Mod

O & I Repair - Proposed - Mod is cell 'Interim'!$F$44 and is labeled ProUnschOIRepCost_Evt. ProUnschOIRepCost_Evt represents the expected cost of materials during unscheduled maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels. The cell formula is
[Cell 'Interim'!$F$44 = Cell 'Input'!$F$53 * Cell 'Input'!$F$54].

Cell 'Input'!$F$53 is labeled ProUnschPctRepOIlev and represents the percentage of time an unscheduled maintenance event will require material cost at the Organizational and Intermediate levels.

Cell 'Input'!$F$54 is labeled ProUnschRepOIlevCost and represents the cost of materials required for an unscheduled maintenance event at the Organizational and Intermediate levels.

5. Depot Repair

a. Current

Depot Repair - Current is cell 'Interim'!$D$45 and is labeled CurUnschDepRepCost_Evt. CurUnschDepRepCost_Evt represents the expected cost of materials during unscheduled maintenance on the current engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$D$45 = Cell 'Input'!$E$57 * Cell 'Input'!$E$58].

Cell 'Input'!$E$57 is labeled CurUnschPctDepotRep and represents the user's estimate of the percentage of time an unscheduled event will require material cost at the Depot level.

Cell 'Input'!$E$58 is labeled CurUnschRepDepotCost and represents the material cost of an unscheduled maintenance event at the Depot level.

b. Proposed - Unmod

Depot Repair - Proposed - Unmod is cell 'Interim'!$E$45 and represents the expected cost of materials during unscheduled maintenance on the unmodified proposed engine configuration at the Depot level. The value is obtained from cell 'Interim'!$D$45 labeled CurUnschDepRepCost_Evt.

c. Proposed - Mod

Depot Repair - Proposed - Mod is cell 'Interim'!$F$45 and is labeled ProUnschDepRepCost_Evt. ProUnschDepRepCost_Evt represents the expected cost of materials during unscheduled maintenance on the modified proposed engine configuration at the Depot level. The cell formula is

[Cell 'Interim'!$F$45 = Cell 'Input'!$F$57 * Cell 'Input'!$F$58].

Cell 'Input'!$F$57 is labeled ProUnschPctDepotRep and represents the user's estimate of the percentage of time an unscheduled event will require material cost at the Depot level.

Cell 'Input'!$F$58 is labeled ProUnschRepDepotCost and represents the material cost of an unscheduled maintenance event at the Depot level.

6. Scrap

a. Current

Scrap - Current is cell 'Interim'!$D$46 and is labeled CurUnschScrapCost_Evt. CurUnschScrapCost_Evt represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the current engine configuration. The cell formula is

[Cell 'Interim'!$D$46 = Cell 'Input'!$E$59 * Cell 'Input'!$E$60].

Cell 'Input'!$E$59 is labeled CurUnschPctScrap and represents the percentage of time an unscheduled maintenance event will discover a component beyond economical repair.

Cell 'Input'!$E$60 is labeled CurUnschPartScpCost and represents the user's estimate of the cost to replace a component which was scrapped as a result of unscheduled maintenance. CurUnschPartScpCost assumes the scrapped component will be replaced by a new unit.

b. Proposed - Unmod

Scrap - Proposed - Unmod is cell 'Interim'!$E$46 and represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$46 labeled CurUnschScrapCost_Evt.

c. Proposed - Mod

Scrap - Proposed - Mod is cell 'Interim'!$F$46 and is labeled ProUnschScrapCost_Evt. ProUnschScrapCost_Evt represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the modified proposed engine configuration. The cell formula is [Cell 'Interim'!$F$46 = Cell 'Input'!$F$59 * Cell 'Input'!$F$60].

Cell 'Input'!$F$59 is labeled ProUnschPctScrap represents the percentage of time an unscheduled maintenance event will discover a component beyond economical repair.

Cell 'Input'!$F$60 is labeled ProUnschPartScpCost and represents the user's estimate of the cost to replace a component which was scrapped as a result of unscheduled maintenance. CurUnschPartScpCost assumes the scrapped component will be replaced by a new unit.

7. Total Material (Line S)

a. Current

Total Material - Current is cell 'Interim'!$D$47, is labeled CurUnschTotMatCost_Evt and represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified. The cell formula is

[Cell 'Interim'!$D$47 = CurUnschOIRepCost_Evt + CurUnschDepRepCost_Evt + CurUnschScrapCost_Evt].

This equals

[Cell 'Interim'!$D$47 = Cell 'Interim'!$D$44 + Cell 'Interim'!$D$45 + Cell 'Interim'!$D$46].

CurUnschOIRepCost_Evt is cell 'Interim'!$D$44 and represents the expected cost of materials during unscheduled maintenance on the current engine configuration at the Organizational and Intermediate levels.

CurUnschDepRepCost_Evt is cell 'Interim'!$D$45 and represents the expected cost of materials during unscheduled maintenance on the current engine configuration at Depot level.

CurUnschScrapCost_Evt is cell 'Interim'!$D$46 and represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the current engine configuration.

b. Proposed - Unmod

Total Material - Proposed - Unmod is cell 'Interim'!$E$47 and represents the expected material cost per unscheduled maintenance event for the unmodified proposed engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified. The value is obtained from cell 'Interim'!$D$47 labeled CurUnschTotMatCost_Evt.

c. Proposed - Mod

Total Material - Proposed - Mod is cell 'Interim'!$F$47 and is labeled ProUnschTotMatCost_Evt. ProUnschTotMatCost_Evt represents the expected material cost per unscheduled maintenance event for the modified proposed engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified. The cell formula is

[Cell 'Interim'!$F$47 = ProUnschOIRepCost_Evt + ProUnschDepRepCost_Evt + ProUnschScrapCost_Evt].

This equals

[Cell 'Interim'!$F$47 = Cell 'Interim'!$F$44 + Cell 'Interim'!$F$45 + Cell 'Interim'!$F$46].

ProUnschOIRepCost_Evt is cell 'Interim'!$F$44 and represents the expected cost of materials during unscheduled maintenance on the modified proposed engine configuration at the Organizational and Intermediate levels.

ProUnschDepRepCost_Evt is cell 'Interim'!$F$45 and represents the expected cost of materials during unscheduled maintenance on the modified proposed engine configuration at Depot level.

ProUnschScrapCost_Evt is cell 'Interim'!$F$46 and represents the expected material cost of replacing the component to be modified, if required, during unscheduled maintenance on the modified proposed engine configuration.

8. Test Labor & Fuel

a. *Current*

Test Labor & Fuel - Current is cell 'Interim'!$D$49, is labeled CurUnschTestLabFuelCost_Evt and represents the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$49 = Cell 'Standard History'!$G$62 * Cell 'Input'!$G$17 * Cell 'Input'!$E$61 + 2 * Cell 'Input'!$G$11 * Cell 'Input'!$E$61].

Cell 'Standard History'!$G$62 is labeled TestFuelGH and represents the fuel consumption rate during engine testing. TestFuelGH is based on the gallons of fuel used per hour of testing, not necessarily engine run time. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon. To change FuelCostGal, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 17.

Cell 'Input'!$E$61 is labeled CurUnschEngTstTime and represents the number of hours required to test an engine after an unscheduled maintenance event. This assumes there are two base level manhours per test hour for labor costs.

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

b. Proposed - Unmod

Test Labor & Fuel - Proposed - Unmod is cell 'Interim'!$E$49 and represents the expected cost of labor and fuel used to test the unmodified proposed engine configuration after unscheduled maintenance at the Organizational and

Intermediate levels. The value is obtained from cell 'Interim'!$D$49 labeled CurUnschTestLabFuelCost_Evt.

c. Proposed - Mod

Test Labor & Fuel - Proposed - Mod is cell 'Interim'!$F$49 and is labeled ProUnschTestLabFuelCost_Evt. ProUnschTestLabFuelCost_Evt represents the expected cost of labor and fuel used to test the modified proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$F$49 = Cell 'Standard History'!$G$62 * Cell 'Input'!$G$17 * Cell 'Input'!$F$61 + 2 * Cell 'Input'!$G$11 * Cell 'Input'!$F$61].

Cell 'Standard History'!$G$62 is labeled TestFuelGH and represents the fuel consumption rate during engine testing. TestFuelGH is based on the gallons of fuel used per hour of testing, not necessarily engine run time. To change TestFuelGH, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 19.

Cell 'Input'!$G$17 is labeled FuelCostGal and represents the cost of fuel per gallon. To change FuelCostGal, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 17.

Cell 'Input'!$F$61 is labeled ProUnschEngTstTime and represents the number of hours required to test an engine after an unscheduled maintenance event. This assumes there are two base level manhours per test hour for labor costs.

Cell 'Input'!$G$11 is labeled LaborCostOI and represents the base labor rate in dollars per man-hour for the Organizational and Intermediate level. To change LaborCostOI, the user must make a change to the applicable standard fleet in the Std_hist.xls file on row 11.

9. Total Material Incl Test (Line T)

a. Current

Total Material Incl Test - Current is cell 'Interim'!$D$50 and represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$D$50 = $CurUnschTotMatCost_Evt + $CurUnschTestLabFuelCost_Evt].

This equals

[Cell 'Interim'!$D$50 = Cell 'Interim'!$D$47 + Cell 'Interim'!$D$49].

CurUnschTotMatCost_Evt is cell 'Interim'!$D$47 and represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

CurUnschTestLabFuelCost_Evt is cell 'Interim'!$D$49 and represents the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

b. Proposed - Unmod

Total Material Incl Test - Proposed - Unmod is cell 'Interim'!$E$50 and represents the expected material cost per unscheduled maintenance event for the unmodified proposed engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus the expected cost of labor and fuel used to test the unmodified proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels. The value is obtained from cell 'Interim'!$D$50.

c. Proposed - Mod

Total Material Incl Test - Proposed - Mod is cell 'Interim'!$F$50 and represents the expected material cost per unscheduled maintenance event for the modified proposed engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus the expected cost of labor and fuel used to test the modified proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels. The cell formula is

[Cell 'Interim'!$F$50 = $ProUnschTotMatCost_Evt +
$ProUnschTestLabFuelCost_Evt].

This equals

[Cell 'Interim'!$F$50 = Cell 'Interim'!$F$47 + Cell
'Interim'!$F$49].

ProUnschTotMatCost_Evt is cell 'Interim'!$F$47 and represents the expected material cost per unscheduled maintenance event for the modified proposed engine configuration, at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

ProUnschTestLabFuelCost_Evt is cell 'Interim'!$F$49 and represents the expected cost of labor and fuel used to test the modified proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

10. Second Damage & Incidental

a. Current

Second Damage & Incidental - Current is cell 'Interim'!$D$52 and is labeled CurUnschSecIncidentalDamCost_Evt. CurUnschSecIncidentalDamCost_Evt represents the cost of damage to other engine parts or components caused by failure of the component being modified on the current engine configuration and expected incidental costs for each unscheduled maintenance event not covered by any other input element. The cell formula is
[Cell 'Interim'!$D$52 = Cell 'Input'!$E$62 + Cell 'Input'!$E$63].

Cell 'Input'!$E$62 is labeled CurUnschSecDamCost and represents the cost of damage to other engine parts or components caused by failure of the component being modified.

Cell 'Input'!$E$63 is labeled CurUnschIncidentalCost and is an estimate of any expected incidental costs for each unscheduled maintenance event not covered by any other input element.

b. Proposed - Unmod

Second Damage & Incidental - Proposed - Unmod is cell 'Interim'!$E$52 and represents the cost of damage to other engine parts or components caused by failure of the component being modified on the unmodified proposed engine configuration and expected incidental costs for each unscheduled maintenance event not covered by any other input element. The value is obtained from cell 'Interim'!$D$52 which is described by the variable name CurUnschSecIncidentalDamCost_Evt.

c. Proposed - Mod

Second Damage & Incidental - Proposed - Mod is cell 'Interim'!$F$52 and is labeled ProUnschSecIncidentalDamCost_Evt. ProUnschSecIncidentalDamCost_Evt represents the cost of damage to other engine parts or components caused by failure of the component being modified on the modified proposed engine configuration and expected incidental costs for each unscheduled maintenance event not covered by any other input element. The cell formula is

[Cell 'Interim'!$F$52 = Cell 'Input'!$F$62 + Cell 'Input'!$F$63].

Cell 'Input'!$F$62 is labeled ProUnschSecDamCost and represents the cost of damage to other engine parts or components caused by failure of the component being modified.

Cell 'Input'!$F$63 is labeled ProUnschIncidentalCost and is an estimate of any expected incidental costs for each unscheduled maintenance event not covered by any other input element.

11. Grand Total Material (Line U)

a. Current

Grand Total Material - Current is cell 'Interim'!$D$53 and is labeled CurTotMatCostUnschEvt. CurTotMatCostUnschEvt represents the total expected material cost per unscheduled maintenance event for the current engine configuration. The cell formula is

[Cell 'Interim'!$D$53 = Cell 'Interim'!$D$50 + CurUnschSecIncidentalDamCost_Evt].

This equals

[Cell 'Interim'!$D$53 = Cell 'Interim'!$D$50 + Cell 'Interim'!$D$52].

Cell 'Interim'!$D$50 represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus the expected cost of labor and fuel used to test the current engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

Cell 'Interim'!$D$52 represents the cost of damage to other engine parts or components caused by failure of the component being modified on the current engine configuration and expected incidental costs for each unscheduled maintenance event not covered by any other input element. Cell 'Interim'!$D$52 is labeled CurUnschSecIncidentalDamCost_Evt.

b. Proposed - Unmod

Grand Total Material - Proposed - Unmod is cell 'Interim'!$E$53 and represents the total expected material cost per unscheduled maintenance event for the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$53 labeled CurTotMatCostUnschEvt.

c. Proposed - Mod

Grand Total Material - Proposed - Mod is cell 'Interim'!$F$53 and is labeled ProTotMatCostUnschEvt. ProTotMatCostUnschEvt represents the total expected material cost per unscheduled maintenance event for the modified proposed engine configuration. The cell formula is

[Cell 'Interim'!$F$53 = Cell 'Interim'!$F$50 + ProUnschSecIncidentalDamCost_Evt].

This equals

[Cell 'Interim'!$F$53 = Cell 'Interim'!$F$50 + Cell 'Interim'!$F$52].

Cell 'Interim'!$F$50 represents the expected material cost per unscheduled maintenance event for the modified proposed engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus the expected cost of labor and fuel used to test the modified proposed engine configuration after unscheduled maintenance at the Organizational and Intermediate levels.

Cell 'Interim'!$F$52 represents the cost of damage to other engine parts or components caused by failure of the component being modified on the modified proposed engine configuration and expected incidental costs for each unscheduled maintenance event not covered by any other input element. Cell 'Interim'!$F$52 is labeled ProUnschSecIncidentalDamCost_Evt.

F. SUMMARY PAGE EQUATIONS

The Summary Page Equations section of the Interim Calculations sheet provides a description of the values calculated in the Summary section of the Summary sheet by displaying the references, equations and formulas used in those calculations. The descriptions are found in column E of the sheet and refer to the "Lines" described in the first five sections of the page.

1. Engineering Development Cost

Engineering Development Cost is displayed in cell 'Interim'!$E$56, refers to cell 'Input'!F68 and represents a cost when the proposed engine configuration engineering developmental costs are greater than those of the current engine configuration.

Cell 'Input'!$F$68 is labeled EngineeringDevelopCost and represents the future cost to fund the design and verification of the component being modified.

2. Production Engine Cost

Production Engine Cost is cell 'Interim'!$E$58 and represents the difference in the production cost, in thousands of dollars, between the current engine configuration and the proposed engine configuration if engines are modified during production over the period of the analysis. The value represents a savings if the proposed engine configuration production costs are less than the current engine configuration production costs. The equation is

[Cell 'Interim'!$E$58 = (Line A * Line G)].

Line A is Delta Production Cost, cell 'Interim'!$D$9, and displays the expected difference in the price of the production engine due to the change. The value is obtained from cell 'Input'!$D$15 labeled DeltaProdCost.

Line G is Engines Modified in Production - Total, cell 'Interim'!$H$14, and represents the total number of engines modified during production over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AO$60 labeled TotEngModProd.

3. Operational Engine Modification Cost

The Operational Engine Modification Cost equation begins in cell 'Interim'!$E$60 and represents the cost of modifying operational engines over the period of the analysis. The costs or savings generated are related to the incorporation of the modification. The equation is

[Cell 'Interim'!$E$60 = IF(Cell 'Input'!D14 = 0,"(Line H_Total * (Line B + Line C))","(Line H_Total * (Line B + Line C) - (Line H_Unsch * Line S + Line H_Sch * Line P))")].

Cell 'Input'!$D$14 is labeled KitCostReplaceNormalMaint and is a switch that identifies if the kit cost is in addition to the normal maintenance material cost (0 = "No") or if it replaces it (1 = "Yes").

Line H_Total is cell 'Interim'!$H$15 and represents the total expected number of engines to be modified over the period of the analysis.

Line B is Kit Cost, cell 'Interim'!$D$10, and is labeled Kit_Cost. Kit_Cost represents the expected material cost of the kit. If the change does not use a kit, Kit_Cost is the cost of the upgraded parts. The value is obtained from cell 'Input'!$D$16 labeled KitCost.

Line C is cell 'Interim'!$D$11, labeled KitLaborCost, and represents the total expected cost of labor per engine modification.

Line H_Unsch is cell 'Interim'!$D$15 and represents the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$CI$60.

Line S is cell 'Interim'!$D$47 and is labeled CurUnschTotMatCost_Evt. CurUnschTotMatCost_Evt represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

Line H_Sch is cell 'Interim'!$E$15 and represents the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$CJ$60.

Line P is cell 'Interim'!$D$33 and is labeled CurSchTotMatCost_Evt. CurSchTotMatCost_Evt represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified.

The IF statement uses the following logic to determine the cost of modifying operational engines over the period of the analysis:

A) If the kit cost is in addition to the normal maintenance material cost then the value displayed is the product of the total expected number of engines to be modified over the period of the analysis and the expected material cost of the kit plus the total expected cost of labor per engine modification.

B) If the kit cost replaces the normal maintenance material cost then the value displayed is the product of the total expected number of engines to be modified over the period of the analysis and the expected material cost of the kit plus the total expected cost of labor per engine modification. From this value, subtract out the product of the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis and the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified plus, the product of the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis and the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified.

4. Follow-on Maintenance Material Cost

The Follow-on Maintenance Material Cost equation begins in cell 'Interim'!$E$62 and represents the difference between material costs of the current and proposed engine configurations. Positive values indicate the current engine configuration is more costly, with respect to maintenance material, and therefore represents a savings if the modification is incorporated. The equation is

[Cell 'Interim'!$E$62 = ((Line K_Cur * Line U_Cur + Line J_Cur * Line Q_Cur) - (Line K_ProUnmod * Line U_ProUnmod + Line J_ProUnmod * Line Q_ProUnmod + Line K_ProMod * Line U_ProMod + Line J_ ProMod * Line Q_ProMod))].

Line K_Cur is cell 'Interim'!$D$20 and represents the total expected number of unscheduled maintenance events generated by the current engine configuration over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$H$60.

Line U_Cur is cell 'Interim'!$D$53 and is labeled CurTotMatCostUnschEvt. CurTotMatCostUnschEvt represents the total expected material cost per unscheduled maintenance event for the current engine configuration.

Line J_Cur is cell 'Interim'!$D$19 and represents the expected number of scheduled maintenance events generated annually by the current engine configuration. The value is obtained from cell '3a 3b 4a 4b'!$J$60.

Line Q_Cur is cell 'Interim'!$D$36 and is labeled CurTotMatCostSch. CurTotMatCostSch represents the total expected cost of materials per scheduled maintenance event on the current engine configuration.

Line K_ProUnmod is cell 'Interim'!$E$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AT$60.

Line U_ProUnmod is cell 'Interim'!$E$53 and represents the total expected material cost per unscheduled maintenance event for the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$53 labeled CurTotMatCostUnschEvt.

Line J_ProUnmod is cell 'Interim'!$E$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AV$60.

Line Q_ProUnmod is cell 'Interim'!$E$36 and represents the total expected cost of materials per scheduled maintenance event on the unmodified proposed engine configuration. The value is obtained from cell 'Interim'!$D$36 labeled CurTotMatCostSch.

Line K_ProMod is cell 'Interim'!$F$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AU$60.

Line U_ProMod is cell 'Interim'!$F$53 and is labeled ProTotMatCostUnschEvt. ProTotMatCostUnschEvt represents the total expected material cost per unscheduled maintenance event for the modified proposed engine configuration.

Line J_ ProMod is cell 'Interim'!$F$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AW$60.

Line Q_ProMod is cell 'Interim'!$F$36 and is labeled ProTotMatCostSch. ProTotMatCostSch represents the total expected cost of materials per scheduled maintenance event on the modified proposed engine configuration.

5. Follow-on Maintenance Labor Cost

The Follow-on Maintenance Labor Cost equation begins in cell 'Interim'!$E$65 and represents the difference between maintenance labor costs for the current and proposed engine configurations. Positive values indicate the current engine configuration is more costly, with respect to maintenance labor, and therefore represents a savings if the modification is incorporated. The equation is

[Cell 'Interim'!$E$65 = '((Line K_Cur * Line R_Cur + Line J_Cur * Line N_Cur) - (Line K_ProUnmod * Line R_ProUnmod + Line J_ProUnmod * Line N_ProUnmod + Line K_ProMod * Line R_ProMod + Line J_ProMod * Line N_ProMod))].

Line K_Cur is cell 'Interim'!$D$20 and represents the total expected number of unscheduled maintenance events generated by the current engine configuration over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$H$60.

Line R_Cur is cell 'Interim'!$D$42 and is labeled CurUnschTotLaborCost_Evt. CurUnschTotLaborCost_Evt represents the total expected cost of labor for maintenance on the current engine configuration generated by unscheduled maintenance events.

Line J_Cur is cell 'Interim'!$D$19 and represents the expected number of scheduled maintenance events generated annually by the current engine configuration. The value is obtained from cell '3a 3b 4a 4b'!$J$60.

Line N_Cur is cell 'Interim'!$D$28 and is labeled CurSchTotLaborCost_Evt. CurSchTotLaborCost_Evt represents the total expected cost of labor for maintenance on the current engine configuration generated by scheduled maintenance events.

Line K_ProUnmod is cell 'Interim'!$E$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AT$60.

Line R_ProUnmod is cell 'Interim'!$E$42 and represents the total expected cost of labor for maintenance on the unmodified proposed engine configuration generated by unscheduled maintenance events. The value is obtained from cell 'Interim'!$D$42 labeled CurUnschTotLaborCost_Evt.

Line J_ProUnmod is cell 'Interim'!$E$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AV$60.

Line N_ProUnmod is cell 'Interim'!$E$28 represents the total expected cost of labor for maintenance on the unmodified proposed engine configuration generated by scheduled maintenance events.

Line K_ProMod is cell 'Interim'!$F$20 and represents the total expected number of unscheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AU$60.

Line R_ProMod is cell 'Interim'!$F$42 and is labeled ProUnschTotLaborCost_Evt. ProUnschTotLaborCost_Evt represents the total expected cost of labor for maintenance on the modified proposed engine configuration generated by unscheduled maintenance events.

Line J_ProMod is cell 'Interim'!$F$19 and represents the total expected number of scheduled maintenance events generated by the component being modified on modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AW$60.

Line N_ProMod is cell 'Interim'!$F$28 and is labeled ProSchTotLaborCost_Evt. ProSchTotLaborCost_Evt represents the total expected cost of labor for maintenance on the modified proposed engine configuration generated by scheduled maintenance events.

6. Publications Cost

Publications Cost is displayed in cell 'Interim'!$E$68 and refers to Line D. Line D is cell 'Interim'!$H$9 and represents the total expected cost of publishing technical manuals and technical orders and directives required by the change. Any publication costs displayed here represent an additional cost of incorporating the modification.

7. Support Equipment Cost

Support Equipment Cost is displayed in cell 'Interim'!$E$70 and refers to Line E. Line E is cell 'Interim'!$H$10 and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification in thousands of dollars. The value is obtained from cell 'Input'!$D$21 labeled ToolSE.Cost. Any support equipment costs displayed here represent an additional cost of incorporating the modification.

8. Part Number Cost

The Part Number Cost equation begins in cell 'Interim'!$E$72 and represents the difference in the costs of maintaining parts in the supply system between the current and proposed engine configurations in thousands of dollars. A positive value indicates an additional cost of incorporating the modification over the current configuration. The equation is

[Cell 'Interim'!$E$72 = (DI60 + DJ60 + EQ80 / 1000) - (BW60)].

The equation uses references established in an earlier version of the CEA Model. Their translations and descriptions are:

DI60 is cell '3a 3b 4a 4b'!$BJ$60 and represents the total expected cost, in thousands of dollars, to maintain part numbers for unmodified engines with the proposed configuration over the period of the analysis.

DJ60 is cell '3a 3b 4a 4b'!$BK$60 and represents the total expected cost, in thousands of dollars, to maintain part numbers for modified engines over the period of the analysis.

EQ80 is cell 'Interim'!$D$80 and is labeled PnIntroCost. PnIntroCost represents the cost of introducing new parts into the supply system.

BW60 is cell '3a 3b 4a 4b'!$X$60 and represents the total expected cost of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis.

9. Operational Fuel Cost

The Operational Fuel Cost equation begins in cell 'Interim'!$E$74 and represents the difference in fuel consumption costs between the current and proposed engine configurations in thousands of dollars. A positive value indicates a savings when the modification is incorporated. The equation is

[Cell 'Interim'!$E$74 = (Line L_Cur * G17 * G20) - (Line L_ProUnmod + Line L_ProMod * (1 - 48)) * G17 * G20].

Line L_Cur is cell 'Interim'!$D$21 and represents the total expected number of engine flight hours flown by the current configuration over the period of the analysis in thousands of hours. The value is obtained from cell '3a 3b 4a 4b'!$F$60.

G17 is cell 'Input'!$G$17, labeled FuelCostGal, and represents the cost of fuel per gallon.

G20 is cell 'Input'!$G$20, labeled FltFuelGH, and represents the fuel consumption rate during flight in gallons per hour.

Line L_ProUnmod is cell 'Interim'!$E$21 and represents the total expected number of engine flight hours, in thousands of hours, logged by unmodified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AR$60.

Line L_ProMod is cell 'Interim'!$F$21 and represents the total expected number of engine flight hours, in thousands of hours, logged by modified engines over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AS$60.

10. Aircraft Loss Cost

The Aircraft Loss Cost equation is displayed in cell 'Interim'!$E$76 and represents the savings in aircraft loss cost associated with incorporating the modification. Aircraft Loss

Cost is the cost associated with the destruction of an aircraft due to a failure of the component being modified. The equation is

[Cell 'Interim'!$E$74 = (Line F * Line M)].

Line F is cell 'Interim'!$H$11, labeled Aircraft Cost, and represents the cost, in fiscal year dollars, of the aircraft in which the modification is being incorporated. The value is obtained from cell 'Input'!$G$26 labeled AirCraftCost.

Line M is cell 'Interim'!$F$22, labeled Aircraft Losses Delta, and represents the change in the total number of aircraft expected to be lost because of the modification over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$AY$60.

11. Cost to Introduce New Part Numbers

Cost to Introduce New Part Numbers is cell 'Interim'!$D$80 labeled PnIntroCost. PnIntroCost represents the cost of introducing new parts into the supply system. The cell formula is:

[Cell 'Interim'!$D$80 = Cell 'Input'!$F$64 * Cell 'Input'!$G$14].

Cell 'Input'!$F$64 represents the number of parts to be added to the system under the proposed configuration.

Cell 'Input'!$G$14 represents the cost to introduce a new part into the supply system.

VIII. DESCRIPTION OF THE SUMMARY SHEET AND PAYBACK CHART SHEET

A. INTRODUCTION

The Summary sheet and Payback Chart sheet give the user a synopsis of the CEA Model's analysis of the engineering change proposal (ECP). The Summary sheet essentially describes the expected savings and costs of incorporating the change and a net present value analysis of the results. The Payback Chart sheet provides the user a graphical representation of the savings projected over the period of the analysis. This chapter describes in detail these two worksheets of the model and all associated equations, formulas and variables.

B. DESCRIPTION OF THE SUMMARY SHEET

The Summary sheet is identified by the worksheet tab labeled 'Summary' and is broken into three areas. The first area provides a block to allow the user to describe the ECP. The second area breaks the additional costs and savings generated by the ECP into ten categories and calculates the net dollar impact, the net present value, the return on investment and the years to return on investment of the ECP. The third area provides a list of assumptions compiled from information drawn from other parts of the model.

1. Change Description Block

The Change Description Block displays the text the user entered into cells 'Input'!$C$85 to 'Input'!$C$94 to describe the engineering change proposal. It is located at the top of the Summary sheet in cells 'Summary'!$C$8 through 'Summary'!$C$17.

2. Summary

The Summary section of the page calculates the fiscal differences between the current and proposed engine configurations in thousands of FY dollars. Those differences are broken into ten cost areas which are further categorized as the cost or savings of incorporating the engineering change proposal.

Cell 'Summary'!$D$21 displays the base fiscal year for the dollar values in the model's net present value calculations and references cell 'Input'!$G$8 labeled YrDollar.

a. Engineering Development Cost

The Engineering Development Cost is obtained directly from the Input sheet and represents the future cost of funding the design of the component being modified.

Cost is cell 'Summary'!$E$24 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration engineering development costs are greater than the current engine configuration engineering development costs. The cell formula is

[Cell 'Summary'!$E$24 = IF(Cell 'Input'!$F$68 > 0, Cell 'Input'!$F$68 / 1000," ")].

Cell 'Input'!$F$68 is labeled EngineeringDevelopCost and represents the future cost to fund the design and verification of the component being modified.

The IF statement uses the following logic to determine the increase in engineering development cost when incorporating the engineering change proposal:

A) If the future cost to fund the design and verification of the component being modified is greater than zero, then the value displayed is the future cost to fund the design and verification of the component being modified divided by 1000.

B) If the future cost to fund the design and verification of the component being modified is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$24 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration engineering development costs are less than the current engine configuration engineering development costs. The cell formula is

[Cell 'Summary'!$H$24 = IF(Cell 'Input'!$F$68 < 0, - Cell 'Input'!$F$68 / 1000," ")].

Cell 'Input'!$F$68 is labeled EngineeringDevelopCost and represents the future cost to fund the design and verification of the component being modified.

The IF statement uses the following logic to determine the increase in engineering development cost when incorporating the engineering change proposal:

A) If the future cost to fund the design and verification of the component being modified is less than zero, then the value displayed is the negative of the future cost to fund the design and verification of the component being modified divided by 1000.

B) If the future cost to fund the design and verification of the component being modified is greater than or equal to zero, then an empty cell is displayed.

b. Production Engine Cost

Production Engine Cost represents the difference in the production cost, in thousands of dollars, between the current engine configuration and the proposed engine configuration if engines are modified during production over the period of the analysis.

Cost is cell 'Summary'!$E$26 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration production engine costs are greater than the current engine configuration production engine costs. The cell formula is

[Cell 'Summary'!$E$26 = IF(Cell 'Input'!D15 > 0, '3a 3b 4a 4b'!BI60," ")].

Cell 'Input'!$D$15 is labeled DeltaProdCost and describes the difference in the price of the production engine due to the change.

Cell '3a 3b 4a 4b'!$BI$60 calculates the total expected difference in production costs, in thousands of dollars, between modified and unmodified engines over the period of the analysis.

The IF statement uses the following logic to determine the increase in production engine cost when incorporating the engineering change proposal:

A) If the difference in the price of the production engine due to the change is greater than zero, then the value displayed is the total expected difference in production costs, in thousands of dollars, between modified and unmodified engines over the period of the analysis.

B) If the difference in the price of the production engine due to the change is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$26 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration production engine costs are less than the current engine configuration production engine costs. The cell formula is

[Cell 'Summary'!$H$26 = IF(Cell 'Input'!D15 < 0, - '3a 3b 4a 4b'!BI60," ")].

Cell 'Input'!$D$15 is labeled DeltaProdCost and describes the difference in the price of the production engine due to the change.

Cell '3a 3b 4a 4b'!$BI$60 calculates the total expected difference in production costs, in thousands of dollars, between modified and unmodified engines over the period of the analysis.

The IF statement uses the following logic to determine the decrease in production engine cost when incorporating the engineering change proposal:

A) If the difference in the price of the production engine due to the change is less than zero, then the value displayed is the negative of the total expected difference in production costs, in thousands of dollars, between modified and unmodified engines over the period of the analysis.

B) If the difference in the price of the production engine due to the change is greater than or equal to zero, then an empty cell is displayed.

c. Operational Engine Modification Cost

The Operational Engine Modification Cost represents the cost of modifying operational engines over the period of the analysis and is calculated in cell 'Summary'!$J$28. The cell formula is

[Cell 'Summary'!$J$28 = (Cell '3a 3b 4a 4b'!BA60 + Cell '3a 3b 4a 4b'!BB60 + Cell '3a 3b 4a 4b'!BD60 + Cell '3a 3b 4a 4b'!BE60) - Cell 'Input'!D14 * ((Cell 'Input'!D25 * Cell 'Interim'!D47 * Cell '3a 3b 4a 4b'!CI60 / 1000) + (Cell 'Input'!D24 * Cell 'Interim'!D33 * Cell '3a 3b 4a 4b'!CJ60 / 1000))].

Cell '3a 3b 4a 4b'!$BA$60 calculates the total expected cost of the modification kits required over the period of the analysis in thousands of dollars.

Cell '3a 3b 4a 4b'!$BB$60 calculates the total expected cost of the labor required to modify the engines over the period of the analysis in thousands of dollars.

Cell '3a 3b 4a 4b'!$BD$60 is the total expected cost of the modification kits required over the period of the analysis for spare engines in thousands of dollars.

Cell '3a 3b 4a 4b'!$BE$60 is the total expected cost of the labor required to incorporate the modification in spare engines over the period of the analysis in thousands of dollars.

Cell 'Input'!$D$14 is labeled KitCostReplaceNormalMaint and is a switch that identifies if the kit cost is in addition to the normal maintenance material cost (0 = "No") or if it replaces it (1 = "Yes") and is entered into.

Cell 'Input'!$D$25, labeled UnschPctEvtMod, represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Interim'!$D$47 is labeled CurUnschTotMatCost_Evt and represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

Cell '3a 3b 4a 4b'!$CI$60 calculates the total expected number of kit incorporation events, for Attrition and 1^{st} Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis.

Cell 'Input'!$D$24, labeled SchPctEvtMod, represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Interim'!$D$33 is labeled CurSchTotMatCost_Evt and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified.

Cell '3a 3b 4a 4b'!$CJ$60 calculates the total expected number of kit incorporation events, for Attrition and 1^{st} Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis.

Cost is cell 'Summary'!$E$28 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration operational engine modification costs are greater than the current engine configuration operational engine modification costs. The cell formula is

[Cell 'Summary'!$E$28 = IF(Cell 'Summary'!J28 > 0, Cell 'Summary'!J28, " ")].

Cell 'Summary'!$J$28 represents the cost of modifying operational engines over the period of the analysis.

The IF statement use the following logic to determine the increase in the operational engine modification cost when incorporating the engineering change proposal:

A) If the cost of modifying operational engines over the period of the analysis is greater than zero, then the value displayed is the cost of modifying operational engines over the period of the analysis.

B) If the cost of modifying operational engines over the period of the analysis is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$28 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration operational engine modification costs are less than the current engine configuration operational engine modification costs. The cell formula is
[Cell 'Summary'!$H$28 = IF(Cell 'Summary'!J28 < 0, - Cell 'Summary'!J28, " ")].

Cell 'Summary'!$J$28 represents the cost of modifying operational engines over the period of the analysis.

The IF statement use the following logic to determine the decrease in the operational engine modification cost when incorporating the engineering change proposal.

A) If the cost of modifying operational engines over the period of the analysis is less than zero, then the value displayed is the negative of the cost of modifying operational engines over the period of the analysis.

B) If the cost of modifying operational engines over the period of the analysis is greater than or equal to zero, then an empty cell is displayed.

d. *Follow-on Maintenance Material Cost*

Follow-on Maintenance Material Cost represents the difference between material costs of the current and proposed engine configurations and is calculated in cell 'Summary'!$J$30. The cell formula is

[Cell 'Summary'!$J$30 = (Cell '3a 3b 4a 4b'!BM60 + Cell '3a 3b 4a 4b'!BO60 + Cell '3a 3b 4a 4b'!BQ60 + Cell '3a 3b 4a 4b'!BS60) + Cell 'Input'!D14 * ((Cell 'Input'!D25 * Cell 'Interim'!D47 * Cell '3a 3b 4a 4b'!CI60 / 1000) + (Cell 'Input'!D24 * Cell Interim!D33 * Cell '3a 3b 4a 4b'!CJ60 / 1000)) - (Cell '3a 3b 4a 4b'!AA60 + Cell '3a 3b 4a 4b'!AC60)].

Cell '3a 3b 4a 4b'!$BM$60 calculates the total expected cost of materials, in thousands of dollars, used in unmodified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BO$60 calculates the total expected cost of materials, in thousands of dollars, for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis.

Cell '3a 3b 4a 4b'!$BQ$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BS$60 calculates the total expected cost of materials, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis.

Cell 'Input'!$D$14 is labeled KitCostReplaceNormalMaint and is a switch that identifies if the kit cost is in addition to the normal maintenance material cost (0 = "No") or if it replaces it (1 = "Yes").

Cell 'Input'!$D$25, labeled UnschPctEvtMod, represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Interim'!$D$47 is labeled CurUnschTotMatCost_Evt and represents the expected material cost per unscheduled maintenance event for the current engine configuration at the Organizational, Intermediate and Depot levels and if required, the cost of replacing the component being modified.

Cell '3a 3b 4a 4b'!$CI$60 calculates the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by unscheduled maintenance events over the period of the analysis.

Cell 'Input'!$D$24, labeled SchPctEvtMod, represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Interim'!$D$33 is labeled CurSchTotMatCost_Evt and represents the expected material cost per scheduled maintenance event at the Organizational, Intermediate and Depot levels for the current engine configuration and if required, the cost of replacing the component being modified.

Cell '3a 3b 4a 4b'!$CJ$60 calculates the total expected number of kit incorporation events, for Attrition and 1st Opportunity Incorporation Styles, generated by scheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$AA$60 is a sum of the expected annual cost of materials generated by unscheduled maintenance events for engines with the current configuration in thousands of dollars.

Cell '3a 3b 4a 4b'!$AC$60 is a sum of the annual costs of materials generated by scheduled maintenance events for the current engine configuration over the period of the analysis in thousands of dollars.

Cost is cell 'Summary'!$E$30 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration follow-on maintenance material costs are greater than the current engine configuration follow-on maintenance material costs. The cell formula is

[Cell 'Summary'!$E$30 = IF(Cell 'Summary'!J30 > 0, Cell 'Summary'!J30, " ")].

Cell 'Summary'!$J$30 represents the difference between material costs of the current and proposed engine configurations.

The IF statement uses the following logic to determine the increase in follow-on maintenance material cost when the engineering change proposal is incorporated:

A) If the difference between material costs of the current and proposed engine configurations is greater than zero, then the value displayed is the difference between material costs of the current and proposed engine configurations.

B) If the difference between material costs of the current and proposed engine configurations is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$30 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration follow-on maintenance material costs are less than the current engine configuration follow-on maintenance material costs. The cell formula is

[Cell 'Summary'!$H$30 = IF(Cell 'Summary'!J30 < 0, - Cell 'Summary'!J30, " ")].

The IF statement uses the following logic to determine the decrease in follow-on maintenance material cost when the engineering change proposal is incorporated:

A) If the difference between material costs of the current and proposed engine configurations is less than zero, then the value displayed is the negative of the difference between material costs of the current and proposed engine configurations.

B) If the difference between material costs of the current and proposed engine configurations is greater than or equal to zero, then an empty cell is displayed.

e. Follow-on Maintenance Labor Cost

Follow-on Maintenance Labor Cost represents the difference between maintenance labor costs for the current and proposed engine configurations.

Cost is cell 'Summary'!$E$32 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration follow-on maintenance labor costs are greater than the current engine configuration follow-on maintenance labor costs. The cell formula is

[Cell 'Summary'!$E$32 = IF((Cell '3a 3b 4a 4b'!BL60 + Cell '3a 3b 4a 4b'!BN60 + Cell '3a 3b 4a 4b'!BP60 + Cell '3a 3b 4a 4b'!BR60) > (Cell '3a 3b 4a 4b'!Z60 + Cell '3a 3b 4a 4b'!AB60), (Cell '3a 3b 4a 4b'!BL60 + Cell '3a 3b 4a 4b'!BN60 + Cell '3a 3b 4a 4b'!BP60 + Cell '3a 3b 4a 4b'!BR60) - (Cell '3a 3b 4a 4b'!Z60 + Cell '3a 3b 4a 4b'!AB60), " ")].

Cell '3a 3b 4a 4b'!$BL$60 calculates the total expected annual cost of labor, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BN$60 calculates the total expected cost of labor, in thousands of dollars, for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis.

Cell '3a 3b 4a 4b'!$BP$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BR$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$Z$60 is a sum of the expected annual costs of labor generated by unscheduled maintenance events for engines with the current configuration in thousands of dollars.

Cell '3a 3b 4a 4b'!$AB$60 is a sum of the annual costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis in thousands of dollars.

The IF statement uses the following logic to determine the increase in follow-on maintenance labor cost when the engineering change proposal is incorporated:

A) If the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis is greater than the sum, in thousands of dollars, of the expected total costs of labor generated by unscheduled maintenance events for engines with the current configuration and the expected total costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis, then the value displayed is the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis minus the sum, in thousands of dollars, of the expected total costs of labor generated by unscheduled maintenance events for engines with the current configuration and the expected total costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis.

B) If the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis is less than or equal to the sum, in thousands of dollars, of the expected total costs of labor generated by unscheduled maintenance events for engines with the current configuration and the expected total costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis, then an empty cell is displayed.

Savings is cell 'Summary'!$H$32 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration follow-on maintenance labor costs are less than the current engine configuration follow-on maintenance labor costs. The cell formula is

[Cell 'Summary'!$H$32 = IF((Cell '3a 3b 4a 4b'!BL60 + Cell '3a 3b 4a 4b'!BN60 + Cell '3a 3b 4a 4b'!BP60 + Cell '3a 3b 4a 4b'!BR60) < (Cell '3a 3b 4a 4b'!Z60 + Cell '3a 3b 4a 4b'!AB60), (Cell '3a 3b 4a 4b'!Z60 + Cell '3a 3b 4a 4b'!AB60) - (Cell '3a 3b 4a 4b'!BL60 + Cell '3a 3b 4a 4b'!BN60 + Cell '3a 3b 4a 4b'!BP60 + Cell '3a 3b 4a 4b'!BR60), " ")].

Cell '3a 3b 4a 4b'!$BL$60 calculates the total expected cost of labor, in thousands of dollars, for unmodified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BN$60 calculates the total expected cost of labor, in thousands of dollars, for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis.

Cell '3a 3b 4a 4b'!$BP$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by unscheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$BR$60 calculates the total expected cost of labor, in thousands of dollars, for modified engines generated by scheduled maintenance events over the period of the analysis.

Cell '3a 3b 4a 4b'!$Z$60 is a sum of the expected annual costs of labor generated by unscheduled maintenance events for engines with the current configuration in thousands of dollars.

Cell '3a 3b 4a 4b'!$AB$60 is a sum of the annual costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis in thousands of dollars.

The IF statement uses the following logic to determine the decrease in follow-on maintenance labor cost when the engineering change proposal is incorporated:

A) If the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis is less than the sum, in thousands of dollars, of the expected total cost of labor generated by unscheduled maintenance events for engines with the current configuration and the expected total costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis, then the value displayed is the sum, in thousands of dollars, of the total expected costs of labor generated by unscheduled maintenance events for engines with the current configuration over the period of the analysis and the total expected cost of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis minus the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis.

B) If the sum, in thousands of dollars, of the total expected annual cost of labor for unmodified engines generated by unscheduled maintenance events over the period of the analysis, the total expected cost of labor for unmodified engines generated by scheduled maintenance events, not including kit installation costs, over the period of the analysis, the total expected cost of labor for modified engines generated by unscheduled maintenance events over the period of the analysis and the total expected cost of labor for modified engines generated by scheduled maintenance events over the period of the analysis is greater than or equal to the sum, in thousands of dollars, of the expected total costs of labor generated by unscheduled maintenance events for engines with the current configuration and the expected total costs of labor generated by scheduled maintenance events for the current engine configuration over the period of the analysis, then an empty cell is displayed.

f. Publications Cost

Publications Cost represents the total expected cost of publishing technical manuals and technical orders and directives required by the change.

Cost is cell 'Summary'!$E$34 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration publication costs are greater than the current engine configuration publication costs. The cell formula is

[Cell 'Summary'!$E$34 = IF((Cell 'Input'!D19 + Cell 'Input'!D20) > 0, (Cell 'Input'!D19 + Cell 'Input'!D20) / 1000, " ")].

Cell 'Input'!$D$19 is labeled TechPubsCost and represents the total cost of the modification or creation of technical publications due to the change.

Cell 'Input'!$D$20 is labeled TctoCost and represents the total cost, in dollars, to produce a Time Compliance Technical Order or Technical Directive if required by the change.

The IF statement uses the following logic to determine the increase in publications cost when the engineering change proposal is incorporated:

A) If the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, is greater than zero, then the value displayed is the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, divided by 1000.

B) If the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$34 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration publication costs are less than the current engine configuration publication costs. The cell formula is

[Cell 'Summary'!$H$34 = IF((Cell 'Input'!D19 + Cell 'Input'!D20) < 0, - (Cell 'Input'!D19 + Cell 'Input'!D20) / 1000, " ")].

Cell 'Input'!$D$19 is labeled TechPubsCost and represents the total cost of the modification or creation of technical publications due to the change.

Cell 'Input'!$D$20 is labeled TctoCost and represents the total cost, in dollars, to produce a Time Compliance Technical Order or Technical Directive if required by the change.

The IF statement uses the following logic to determine the decrease in publications cost when the engineering change proposal is incorporated:

A) If the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, is less than zero, then the value displayed is the negative of the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, divided by 1000.

B) If the sum of the total cost of the modification or creation of technical publications due to the change and the total cost to produce a Time Compliance Technical Order or Technical Directive, if required by the change, is greater than or equal to zero, then an empty cell is displayed.

g. Support Equipment Cost

Support Equipment Cost represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification.

Cost is cell 'Summary'!$E$36 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration support equipment costs are greater than the current engine configuration support equipment costs. The cell formula is

[Cell 'Summary'!$E$36 = IF(Cell 'Input'!D21 > 0, Cell 'Input'!D21 / 1000," ")].

Cell 'Input'!$D$21 is labeled ToolSE.Cost and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification.

The IF statement uses the following logic to determine the increase in support equipment cost when the engineering change proposal is incorporated:

A) If the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification is greater than zero, then the value displayed is the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification divided by 1000.

B) If the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$36 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration support equipment costs are less than the current engine configuration support equipment costs. The cell formula is

[Cell 'Summary'!$H$36 = IF(Cell 'Input'!D21 < 0, - Cell 'Input'!D21 / 1000," ")].

Cell 'Input'!$D$21 is labeled ToolSE.Cost and represents the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification.

The IF statement uses the following logic to determine the increase in support equipment cost when the engineering change proposal is incorporated:

A) If the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification is less than zero, then the value displayed is the negative of the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification divided by 1000.

B) If the total amount estimated by the contractor for tooling or support equipment required to complete the component's modification is greater than or equal to zero, then an empty cell is displayed.

h. Part Number Cost

Part Number Cost represents the difference in the costs of maintaining parts in the supply system between the current and proposed engine configurations.

Cost is cell 'Summary'!$E$38 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration part number costs are greater than the current engine configuration part number costs. The cell formula is

[Cell 'Summary'!$E$38 = IF(Cell '3a 3b 4a 4b'!BJ60 + Cell '3a 3b 4a 4b'!BK60 + Cell 'Interim'!D80 / 1000 > Cell '3a 3b 4a 4b'!X60, Cell '3a 3b 4a 4b'!BJ60 + Cell '3a 3b 4a 4b'!BK60 + Cell 'Interim'!D80 / 1000 - Cell '3a 3b 4a 4b'!X60, " ")].

Cell '3a 3b 4a 4b'!$BJ$60 represents the total expected cost, in thousands of dollars, to maintain part numbers for unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$BK$60 represents the total expected cost, in thousands of dollars, to maintain part numbers for modified engines over the period of the analysis.

Cell 'Interim'!$D$80 and is labeled PnIntroCost and represents the cost of introducing new parts into the supply system.

Cell '3a 3b 4a 4b'!$X$60 represents the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis.

The IF statement uses the following logic to determine the increase in part number cost when the engineering change proposal is incorporated:

A) If the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000 is greater than the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis, then the value displayed is the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000 minus the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis.

B) If the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000 is less than or equal to the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis, then an empty cell is displayed.

Savings is cell 'Summary'!$H$38 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration part number costs are less than the current engine configuration part number costs. The cell formula is

[Cell 'Summary'!$H$38 = IF(Cell '3a 3b 4a 4b'!BJ60 + Cell '3a 3b 4a 4b'!BK60 + Cell 'Interim'!D80 / 1000 < Cell '3a 3b 4a 4b'!X60, Cell '3a 3b 4a 4b'!X60 - Cell '3a 3b 4a 4b'!BJ60 - Cell '3a 3b 4a 4b'!BK60 - Cell 'Interim'!D80 / 1000, " ")].

Cell '3a 3b 4a 4b'!$BJ$60 represents the total expected cost, in thousands of dollars, to maintain part numbers for unmodified engines over the period of the analysis.

Cell '3a 3b 4a 4b'!$BK$60 represents the total expected cost, in thousands of dollars, to maintain part numbers for modified engines over the period of the analysis.

Cell 'Interim'!$D$80 and is labeled PnIntroCost and represents the cost of introducing new parts into the supply system.

Cell '3a 3b 4a 4b'!$X$60 represents the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis.

The IF statement uses the following logic to determine the decrease in part number cost when the engineering change proposal is incorporated:

A) If the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000 is less than the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis, then the value displayed is the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis minus the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000.

B) If the sum, in thousands of dollars, of the total expected cost to maintain part numbers for unmodified engines over the period of the analysis, the total expected cost to maintain part numbers for modified engines over the period of the analysis and the cost of introducing new parts into the supply system divided by 1000 is greater than or equal to the total expected cost, in thousands of dollars, of maintaining the parts required to support the current engine configuration component being modified over the period of the analysis, then an empty cell is displayed.

i. Operational Fuel Cost

Operational Fuel Cost represents the difference in fuel consumption costs between the current and proposed engine configurations.

Cost is cell 'Summary'!$E$40 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration operational fuel costs are greater than the current engine configuration operational fuel costs. The cell formula is

[Cell 'Summary'!$E$40 = IF(Cell '3a 3b 4a 4b'!BV60 > Cell '3a 3b 4a 4b'!AJ60, Cell '3a 3b 4a 4b'!BV60 - Cell '3a 3b 4a 4b'!AJ60, " ")].

Cell '3a 3b 4a 4b'!$BV$60 represents the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis.

Cell '3a 3b 4a 4b'!$AJ$60 represents the total expected operational fuel costs, in thousands of dollars, for engines with the current configuration over the period of the analysis.

The IF statement uses the following logic to determine the increase in operational fuel cost when the engineering change proposal is incorporated:

A) If the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis is greater than the total expected operational fuel costs, in thousands of dollars, for current engine configuration over the period of the analysis, then the value displayed is the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis minus the total expected operational fuel costs, in thousands of dollars, for current engine configuration over the period of the analysis.

B) If the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis is less than or equal to the total expected operational fuel costs, in thousands of dollars, for current engine configuration over the period of the analysis, then an empty cell is displayed.

Savings is cell 'Summary'!$H$40 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration operational fuel costs are less than the current engine configuration operational fuel costs. The cell formula is

[Cell 'Summary'!$H$40 = IF(Cell '3a 3b 4a 4b'!AJ60 > Cell '3a 3b 4a 4b'!BV60, Cell '3a 3b 4a 4b'!AJ60 - Cell '3a 3b 4a 4b'!BV60, " ")].

Cell '3a 3b 4a 4b'!$AJ$60 represents the total expected operational fuel costs, in thousands of dollars, for engines with the current configuration over the period of the analysis.

Cell '3a 3b 4a 4b'!$BV$60 represents the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis.

The IF statement uses the following logic to determine the decrease in operational fuel cost when the engineering change proposal is incorporated:

A) If the total expected operational fuel costs, in thousands of dollars, for engines with the current configuration over the period of the analysis is greater than the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis, then the value displayed is the total expected operational fuel costs, in thousands of dollars, for engines with the current configuration over the period of the analysis minus the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis.

B) If the total expected operational fuel costs, in thousands of dollars, for engines with the current configuration over the period of the analysis is less than or equal to the total expected operational fuel costs, in thousands of dollars, for engines with the proposed configuration over the period of the analysis, then an empty cell is displayed.

j. Aircraft Loss Cost

Aircraft Loss Cost represents the savings in aircraft loss costs associated with incorporating the modification. The Aircraft Loss Cost includes only those costs incurred as the result of destruction of an aircraft due to the failure of the component being modified.

Cost is cell 'Summary'!$E$42 and represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration aircraft loss costs are greater than the current engine configuration aircraft loss costs. The cell formula is

[Cell 'Summary'!$E$42 = IF(Cell '3a 3b 4a 4b'!BW60 > 0, - Cell '3a 3b 4a 4b'!BW60," ")].

Cell '3a 3b 4a 4b'!$BW$60 represents the total expected cost of losing aircraft with the proposed engine configuration due to the failure of the component being modified, in thousands of dollars, over the period of the analysis. Aircraft loss costs are those costs incurred when the failure of the component being modified causes the destruction of the aircraft.

The IF statement uses the following logic to determine the increase in aircraft loss cost when the engineering change proposal is incorporated:

A) If the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis is greater than zero, then the value displayed is the negative of the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis.

B) If the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis is less than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$42 and represents the decrease in cost, in thousands of dollars, generated when the proposed engine configuration aircraft loss costs are less than the current engine configuration aircraft loss costs. The cell formula is

[Cell 'Summary'!$H$42 = IF(Cell '3a 3b 4a 4b'!BW60 < 0, - Cell '3a 3b 4a 4b'!BW60," ")].

Cell '3a 3b 4a 4b'!$BW$60 represents the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis. Aircraft loss costs are those costs incurred when the failure of the component being modified causes the destruction of the aircraft.

The IF statement uses the following logic to determine the decrease in aircraft loss cost when the engineering change proposal is incorporated:

A) If the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis is less than zero, then the value displayed is the negative of the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis.

B) If the total expected cost of losing aircraft with the proposed engine configuration, in thousands of dollars, over the period of the analysis is greater than or equal to zero, then an empty cell is displayed.

k. Totals

Cell 'Summary'!$E$43 calculates the total additional engine life cycle cost when the engineering change proposal is incorporated. The cell formula is

[Cell 'Summary'!$E$43 = SUM(Cell 'Summary'!E24: Cell 'Summary'!E42)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

Cell 'Summary'!$H$43 calculates the total engine life cycle savings when the engineering change proposal is incorporated. The cell formula is

[Cell 'Summary'!$H$43 = SUM(Cell 'Summary'!H24: Cell 'Summary'!H42)].

SUM is an EXCEL worksheet function that returns the sum of a set of values contained in a specified field.

1. Net Delta Dollar Impact

Net Delta Dollar Impact is the difference between the total additional cost and the total savings calculated for the ten cost categories. The net figure represents the additional costs or savings applied to the engine life cycle cost when the engineering change proposal is incorporated.

Cost is cell 'Summary'!$E$46 and represents the increase in engine life cycle cost, in thousands of dollars, generated when the proposed engine configuration costs are greater than the proposed engine configuration savings. The cell formula is

[Cell 'Summary'!$E$46 = IF(Cell 'Summary'!H43 < Cell 'Summary'!E43, Cell 'Summary'!E43 - Cell 'Summary'!H43," ")].

Cell 'Summary'!$H$43 represents the total engine life cycle savings when the engineering change proposal is incorporated.

Cell 'Summary'!$E$43 represents the total additional engine life cycle cost when the engineering change proposal is incorporated.

The IF statement uses the following logic to determine the increase in life cycle cost when the engineering change proposal is incorporated:

A) If the total savings when incorporating the engineering change proposal is less than the total cost when incorporating the engineering change proposal, then the value displayed is the total cost when incorporating the engineering change proposal minus the total savings when incorporating the engineering change proposal.

B) If the total savings when incorporating the engineering change proposal is greater than or equal to the total cost when incorporating the engineering change proposal, then an empty cell is displayed.

Savings is cell 'Summary'!$H$46 and represents the decrease in engine life cycle cost, in thousands of dollars, generated when the proposed engine configuration costs are less than the proposed engine configuration savings. The cell formula is

[Cell 'Summary'!$H$46 = IF(Cell 'Summary'!H43 > Cell 'Summary'!E43, Cell 'Summary'!H43 - Cell 'Summary'!E43," ")].

Cell 'Summary'!$H$43 represents the total engine life cycle savings when the engineering change proposal is incorporated.

Cell 'Summary'!$E$43 represents the total additional engine life cycle cost when the engineering change proposal is incorporated.

The IF statement uses the following logic to determine the decrease in engine life cycle cost when the engineering change proposal is incorporated:

A) If the total savings when incorporating the engineering change proposal is greater than the total cost when incorporating the engineering change proposal, then the value displayed is the total savings when incorporating the engineering change proposal minus the total cost when incorporating the engineering change proposal.

B) If the total savings when incorporating the engineering change proposal is less than or equal to the total cost when incorporating the engineering change proposal, then an empty cell is displayed.

m. Net Present Value at XX %

Cell 'Summary'!$D$48 displays the discount rate used in the net present value calculations in the model. Net present value is the difference between the discounted present value of benefits and the discounted present vâlue of costs. The value is obtained from cell 'Input'!$G$9 labeled NPVrate.

Cost is cell 'Summary'!$E$48 and represents the net present value of the change in engine life cycle cost, in thousands of dollars, generated when the proposed engine configuration costs are greater than the proposed engine configuration savings. The cell formula is

[Cell 'Summary'!$E$48 = IF(Cell '5'!E62 < 0, - Cell '5'!E62, " ")].

Cell '5'!$E$62 calculates the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis.

The IF statement uses the following logic to determine the net present value of the increase in engine life cycle cost:

A) If the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis is less than zero, then the value displayed is the negative of the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis.

B) If the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis is greater than or equal to zero, then an empty cell is displayed.

Savings is cell 'Summary'!$H$48 and represents the net present value of the change in engine life cycle cost, in thousands of dollars, generated when the proposed engine configuration costs are less than the proposed engine configuration savings. The cell formula is

[Cell 'Summary'!$H$48 = IF(Cell '5'!E62 > 0, Cell '5'!E62," ")].

Cell '5'!$E$62 calculates the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis.

The IF statement uses the following logic to determine the net present value of the decrease in engine life cycle cost:

A) If the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis is greater than zero, then the value displayed is the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis.

B) If the net present value of the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis is less than or equal to zero, then an empty cell is displayed.

n. Return on Investment

Return on Investment (ROI) is calculated in cell 'Summary'!$D$51. The cell formula is

[Cell 'Summary'!$D$51 = IF((Cell 'Summary'!E24 + Cell 'Summary'!E26 + Cell 'Summary'!E28 + Cell 'Summary'!E34 + Cell 'Summary'!E36 + Cell 'Summary'!E38) <> 0, Cell 'Summary'!'5'!E60 / (Cell 'Summary'!E24 + Cell 'Summary'!E26 + Cell 'Summary'!E28 + Cell 'Summary'!E34 + Cell 'Summary'!E36 + Cell 'Summary'!E38), " ")].

Cell 'Summary'!$E$24 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration engineering development costs are greater than the current engine configuration engineering development costs.

Cell 'Summary'!$E$26 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration production engine costs are greater than the current engine configuration production engine costs.

Cell 'Summary'!$E$28 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration operational engine modification costs are greater than the current engine configuration operational engine modification costs.

Cell 'Summary'!$E$34 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration publication costs are greater than the current engine configuration publication costs.

Cell 'Summary'!$E$36 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration support equipment costs are greater than the current engine configuration support equipment costs.

Cell 'Summary'!$E$38 represents the increase in cost, in thousands of dollars, generated when the proposed engine configuration part number costs are greater than the current engine configuration part number costs.

Cell '5'!$E$60 represents the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis.

The IF statement uses the following logic to determine engineering change proposal's ROI:

A) If the sum of the engineering development costs, production engine costs, engine modification costs, publication costs, support equipment costs and part number costs do not equal zero, then the value displayed is the total expected annual savings of the proposed engine configuration over the current engine configuration during the period of the analysis divided by the sum of the engineering development costs, production engine costs, engine modification costs, publication costs, support equipment costs and part number costs.

B) If the sum of the engineering development costs, production engine costs, engine modification costs, publication costs, support equipment costs and part number costs equal zero, then an empty cell is displayed.

o. Years to Return Investment

Years to Return Investment is cell 'Summary'!$H$51 and represents the time required to recoup the investment in the engineering change proposal. The cell formula is

[Cell 'Summary'!$H$51 = PayBackYrs(Cell '5'!$E$14: Cell '5'!$E$58, Cell '5'!$F$14: Cell '5'!$F$58)].

Cell '5'!$E$14 through cell '5'!$E$58 represent the expected annual savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars.

Cell '5'!$F$14 through cell '5'!$F$58 represent the expected cumulative savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars.

PayBackYrs is a user defined function which calculates an investment's break-even point contained in a specified field.

3. Assumptions

The Assumptions section of the page reiterates information entered or calculated in other parts of the model.

a. Incorporation in Production engines will begin in

"Incorporation in Production engines will begin in" is displayed in cells 'Summary'!$F$54 and 'Summary'!$G$54 and represents the month and year the engineering change proposal will begin to be incorporated into production engines if the modification can be accomplished during production.

Cell 'Summary'!$F$54 determines the month in which the engineering change proposal will begin to be incorporated into production engines. The cell formula is

[Cell 'Summary'!$F$54 = IF(Cell '3a 3b 4a 4b'!AO60 = 0, " ", IF(Cell 'Input'!D28 > Cell 'Standard History'!B58, " ", CHOOSE(Cell 'Input'!F28, Cell 'Summary'!J51, Cell 'Summary'!J52, Cell 'Summary'!J53, Cell 'Summary'!J54, Cell 'Summary'!J55, Cell 'Summary'!J56, Cell 'Summary'!J57, Cell 'Summary'!J58, Cell 'Summary'!J59, Cell 'Summary'!J60, Cell 'Summary'!J61, Cell 'Summary'!J62)))].

Cell '3a 3b 4a 4b'!$AO$60 is labeled TotEngModProd and represents the total number of engines modified during production over the period of the analysis.

Cell 'Input'!$D$28 is labeled ProdIncorpYr and represents the contractor's estimate of the year the change will begin to be incorporated into engines in production.

Cell 'Standard History'!$B$58 represents the last calendar year of the period of analysis.

Cell 'Input!$F$28 is labeled ProdIncorpMo and represents the contractor's estimate of the month the change will begin to be incorporated into engines in production.

Cell 'Summary'!$J$51 to Cell 'Summary'!$J$62 represent the months of the calendar year.

CHOOSE is an EXCEL worksheet function which compares an index to a list of value arguments to return a value.

The IF statement uses the following logic to determine the month in which the engineering change proposal will begin to be incorporated into production engines:

A) If the total number of engines modified during production over the period of the analysis equals zero, then an empty cell is displayed.

B) If the total number of engines modified during production over the period of the analysis does not equal zero, then the contractor's estimate of the year the change will begin to be incorporated into engines in production is compared to the last calendar year of the period of analysis.

1) If the contractor's estimate of the year the change will begin to be incorporated into engines in production is greater than the last calendar year of the period of analysis, then an empty cell is displayed.

2) If the contractor's estimate of the year the change will begin to be incorporated into engines in production is less than or equal to the last calendar year of the period of

analysis, then the contractor's estimate of the month the change will begin to be incorporated into engines in production will be displayed.

Cell 'Summary'!$G$54 determines the year in which the engineering change proposal will begin to be incorporated into production engines. The cell formula is

[Cell 'Summary'!$G$54 = IF(Cell '3a 3b 4a 4b'!AO60 = 0, NA(), IF(Cell 'Input'!D28 > Cell 'Standard History'!B58, NA(), Cell 'Input'!D28))].

Cell '3a 3b 4a 4b'!$AO$60 is labeled TotEngModProd and represents the total number of engines modified during production over the period of the analysis.

Cell 'Input'!$D$28 is labeled ProdIncorpYr and represents the contractor's estimate of the year the change will begin to be incorporated into engines in production.

Cell 'Standard History'!$B$58 represents the last calendar year of the period of analysis.

The IF statement uses the following logic to determine the year in which the engineering change proposal will begin to be incorporated into production engines:

A) If the total number of engines modified during production over the period of the analysis equals zero, then the error value "#N/A" is displayed.

B) If the total number of engines modified during production over the period of the analysis does not equal zero, then the contractor's estimate of the year the change will begin to be incorporated into engines in production is compared to the last calendar year of the period of analysis.

1) If the contractor's estimate of the year the change will begin to be incorporated into engines in production

is greater than the last calendar year of the period of analysis, then the error value "#N/A" is displayed.

2) If the contractor's estimate of the year the change will begin to be incorporated into engines in production is less than or equal to the last calendar year of the period of analysis, then the contractor's estimate of the year the change will begin to be incorporated into engines in production will be displayed.

b. Number of engines produced with this change is

"Number of engines produced with this change is" is displayed in cell 'Summary'!$G$55 and represents the total number of engines modified during production over the period of the analysis. The value is obtained from Cell '3a 3b 4a 4b'!$AO$60 labeled TotEngModProd.

c. Number of spare units incorporated in this change

"Number of spare units incorporated in this change" is displayed in cell 'Summary'!$G$56 and represents the total expected number of spare engines to be modified over the period of the analysis. The value is obtained from cell '3a 3b 4a 4b'!$BC$60.

d. Modification of operational engines can begin in

"Modification of operational engines can begin in" is displayed in cells 'Summary'!$F$57 and 'Summary'!$G$57 and represent the year and month the engineering change proposal can begin to be incorporated into operational engines.

Cell 'Summary'!$F$57 represents the month the engineering change proposal can begin to be incorporated into operational engines. The cell formula is

[Cell 'Summary'!$F$57 = IF(Cell 'Input'!D24 + Cell 'Input'!D25 = 0, " ", CHOOSE(Cell 'Input'!F29, Cell 'Summary'!J51, Cell 'Summary'!J52, Cell 'Summary'!J53, Cell 'Summary'!J54, Cell 'Summary'!J55, Cell 'Summary'!J56, Cell 'Summary'!J57, Cell 'Summary'!J58, Cell 'Summary'!J59, Cell 'Summary'!J60, Cell 'Summary'!J61, Cell 'Summary'!J62))].

Cell 'Input'!$D$24 is labeled SchPctEvtMod and represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Input!$F$29 is labeled FieldIncorpMo and represents the contractor's estimate of the month the change will begin to be incorporated into engines already produced.

Cell 'Summary'!$J$51 to Cell 'Summary'!$J$62 represent the months of the calendar year.

CHOOSE is an EXCEL worksheet function which compares an index to a list of value arguments to return a value.

The IF statement uses the following logic to determine the month the engineering change proposal can begin to be incorporated into operational engines:

A) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed equals zero, then an empty cell is displayed.

B) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed does not equal zero, then the contractor's estimate of the month the change will begin to be incorporated into engines already produced is displayed.

Cell 'Summary'!$G$57 represents the year the engineering change proposal can begin to be incorporated into operational engines. The cell formula is

[Cell 'Summary'!$G$57 = IF(Cell 'Input'!D24 + Cell 'Input'!D25 = 0, " ", Cell 'Input'!D29)].

Cell 'Input'!$D$24 is labeled SchPctEvtMod and represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Input!$D$29 is labeled FieldIncorpYr and represents the contractor's estimate of the year the change will begin to be incorporated into engines already produced.

The IF statement uses the following logic to determine the year the engineering change proposal can begin to be incorporated into operational engines:

A) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed equals zero, then an empty cell is displayed.

B) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed does not equal zero, then the contractor's estimate of the year the change will begin to be incorporated into engines already produced is displayed.

e. Incorporation of this change in operational engines will be accomplished by

"Incorporation of this change in operational engines will be accomplished by" is displayed in cells 'Summary'!$E$59 and 'Summary'!$G$59 and represents how and where the change is incorporated into operational engines.

Cells 'Summary'!$E$59 represents how the change is incorporated into operational engines. The cell formula is

[Cell 'Summary'!$E$59 = IF(Cell 'Input'!D24 + Cell 'Input'!D25 = 0, " ", IF(Cell 'Input'!D9 = 1, "Attrition", IF(Cell Input!D9 = 2, "1st Opportunity", (IF(Cell 'Input'!D9 = 3, "Forced Ret.", "See ECP")))))].

Cell 'Input'!$D$24 is labeled SchPctEvtMod and represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$9 is labeled IncorpStyle and represents how the change is incorporated. The user is given three options:

1 = <u>Attrition</u> - Incorporates the change as failures occur in the engines. The parts are replaced as spares and no useable hardware is scrapped, or

2 = <u>Retrofit at First Opportunity</u> - Incorporates the change when scheduled or unscheduled maintenance provides access to the part, whichever occurs first, or

3 = Forced Retrofit - Incorporates the change via an independent maintenance event with an objective of implementing the change. The rate, in kits per month, the change is incorporated into the engine is entered in cell 'Input'$D$12 and is labeled ForcedRetroRate.

The IF statement uses the following logic to determine how the change is incorporated into operational engines:

A) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed equals zero, then an empty cell is displayed.

B) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed does not equal zero, then:

1) If the user chose 1 for the incorporation method, then "Attrition" is displayed.

2) If the user chose 2 for the incorporation method, then "1st Opportunity" is displayed.

3) If the user chose 3 for the incorporation method, then "Forced Ret." is displayed.

4) If the user made any other choice for the incorporation method, then "See ECP" is displayed.

Cell 'Summary'!$G$59 represents where the change is incorporated into operational engines. The cell formula is

[Cell 'Summary'!$G$59 = IF(Cell 'Input'!D24 + Cell 'Input'!D25 = 0, " ", IF(Cell 'Input'!D18 > 0, "Depot", IF(Cell 'Input'!D17 > 0, "O & I ", "See ECP")))].

Cell 'Input'!$D$24 is labeled SchPctEvtMod and represents the percentage of scheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$25 is labeled UnschPctEvtMod and represents the percentage of unscheduled maintenance events during which modifications can be performed.

Cell 'Input'!$D$18 is labeled KitLaborDepot and represents the base level man-hours required to install the kit at the Depot level.

Cell 'Input'!$D$17 is labeled KitLaborOI and represents the base level man-hours required to install the kit at the Organizational or Intermediate level (O & I).

The IF statement uses the following logic to determine where the change is incorporated into operational engines:

A) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed equals zero, then an empty cell is displayed.

B) If the percentage of scheduled maintenance events during which modifications can be performed plus the percentage of unscheduled maintenance events during which modifications can be performed does not equal zero, then:

1) If the base level man-hours required to install the kit at the Depot level is greater than zero, then "Depot" is displayed.

2) If the base level man-hours required to install the kit at the Depot level is less than or equal to zero, then:

a) If the base level man-hours required to install the kit at the Organizational or Intermediate level (O & I) is greater than zero, then "O & I" is displayed.

b) If the base level man-hours required to install the kit at the Organizational or Intermediate level (O & I) is less than or equal to zero, then "See ECP" is displayed.

f. Total kits installed out of total kits not modified in production is

"Total kits installed out of total kits not modified in production is" is displayed in cells 'Summary'!$E$61 and 'Summary'!$G$61.

Cell 'Summary'!$E$61 represents the total expected number of engines to be modified over the period of the analysis and obtains its value from cell '3a 3b 4a 4b'!$AZ$60.

Cell 'Summary'!$G$61 represents the number of engines delivered, but not modified during production. The cell formula is

[Cell 'Summary'!$G$61 = Cell 'Standard History'!E60 - Cell '3a 3b 4a 4b'!AO60].

Cell 'Standard History'!$E$60 is labeled TotEngDel and represents the total number of engines delivered over the period of the analysis.

Cell '3a 3b 4a 4b'!$AO$60 is labeled TotEngModProd and represents the total number of engines modified during production over the period of the analysis.

g. Total engines lost to attrition is

"Total engines lost to attrition is" is displayed in cell 'Summary'!$G$62 and represents the number of engines lost through attrition during the period of the analysis. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives. The value is obtained from cell 'Standard History'!$J$60.

h. Total engines retired unmodified is

"Total engines retired unmodified is" is displayed in cell 'Summary'!$G$63. The cell formula is

[Cell 'Summary'!$G$63 = MAX('Summary'!G61 - 'Summary'!E61 - 'Summary'!G62, 0)].

Cell 'Summary'!$G$61 represents the number of engines delivered, but not modified during production.

Cell 'Summary'!$E$61 represents the total expected number of engines to be modified over the period of the analysis.

Cell 'Summary'!$G$62 represents the number of engines lost through attrition during the period of the analysis. Attrition, in this case, is defined as the reduction of engines from the fleet inventories as they reach the end of their useful lives.

MAX is an EXCEL worksheet function that returns the largest value from a list of arguments.

i. Estimated yearly flying hours

"Estimated yearly flying hours" is displayed in cell 'Summary'!$E$64 and represents the expected number of engine flight hours (EFH) per year. The value is obtained from cell 'Standard History'!$D$62 labeled EfhYr.

C. DESCRIPTION OF THE PAYBACK CHART SHEET

The Payback Chart sheet is identified by the worksheet tab labeled 'Payback Chart'. The Payback Chart sheet provides a graphical representation of the CEA results by showing cumulative net cashflow and cumulative net present value as a function of the calendar years of the analysis.

Title - The title of the chart page is obtained from cell 'Input'!$B$4.

Task/ECP - The Task/ECP is obtained from cell 'Input'!$B$6.

Engine Model - The Engine Model number is obtained from cell 'Input'!$B$5.

Cumulative Savings - The Cumulative Savings line is graphed as a blue line. The equation designating this line is ["Cumulative Savings" = SERIES("Cumulative Savings", Cell '5'!$B$15: Cell '5'!$B$59, Cell '5'!$F$14: Cell '5'!$F$58, 1)].

Cumulative Savings represents the name of the data series.

Cell '5'!$B$15 to Cell '5'!$B$59 represents the X values of the data series. Column B of page 5 of the CEA Model displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model.

Cell '5'!$F$14 to Cell '5'!$F$58 represents the Y values of the data series. Column F of page 5 of the CEA Model calculates the expected cumulative savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars.

The "1" indicates the series is data series one, in this case, cumulative savings.

Cumulative NPV at XX %- The Cumulative NPV line is graphed as a red line. The equation designating this line is
["Cumulative NPV at XX %" = SERIES("Cumulative NPV at ", Cell '5'!$B$15: Cell '5'$B$59, Cell '5'!$G$14: Cell '5'$G$58, 2)].

Cumulative NPV at XX % represents the name of the data series.

Cell '5'!$B$15 to Cell '5'!$B$59 represent the X values of the data series. Column B of page 5 of the CEA Model displays the calendar year of the calculations for each year of the analysis. The values are obtained from the Standard History sheet of the CEA Model.

Cell '5'!$G$14 to Cell '5'!$G$58 represent the Y values of the data series. Column G of page 5 of the CEA Model calculates the net present value of the expected annual savings of the proposed engine configuration over the current engine configuration for each year of the analysis in thousands of dollars.

The "2" indicates the series is data series two, in this case, cumulative net present value.

The percentage in the series name "Cumulative NPV at XX %" in the legend represents the discount rate at which net present value calculations in the model are made. The value is obtained from cell 'Input'!$G$9.

IX. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

This thesis develops a comprehensive procedures manual for Version 3.0 of the Cost Effectiveness Analysis (CEA) Model. The CEA Model is used in each service's Component Improvement Program (CIP) as a means of doing cost effectiveness analysis on engineering change proposals (ECPs) for aircraft engines. The model uses expected values to calculate changes in life cycle cost that result from implementation of the ECP.

A detailed analysis of the spreadsheet's calculations is provided to explain to users the logic in the model. This comprehensive manual covers the model's history, assumptions, limitations and format. Each page of the model is described in detail including its purpose, explanations of each column, associated cell formulas and the logic behind them. The appendix provides a sample of each page of the CEA Model.

This User's Manual is intended to be used as a reference. The idea for the original CEA Model User's Manual came from the need to help users understand and validate the model. This User's Manual will also assist users and programmers with those tasks. Users with "how to" questions should refer to the User's Guide provided with the CEA Deck software. Questions regarding EXCEL operation should be directed to the EXCEL on-line help.

B. CONCLUSIONS

The CEA Model Version 3.0 uses a straight forward approach in calculating the effects of an engineering change proposal on an engine's life cycle cost. The logic used can be difficult to trace due to the model's spreadsheet format. Version 3.0 is a leap ahead in simplicity over the previous version of the spreadsheet, Version 2.0. The removal of the integerization in the model's logic eliminated the need for a number of columns and other modifications make the model more user friendly.

C. RECOMMENDATIONS

Prior to attempting a CEA Model analysis, CEA Model users should be thoroughly familiar with the User's Guide, the model's format, assumptions, and its limitations and logic as explained in this User's Manual. It is also recommended the user have an understanding of the respective service's Component Improvement Program and the engineering change proposal process prior to attempting an analysis.

Any changes to the CEA Model must follow the prescribed procedures as outlined in Chapter 3 of the User's Guide.

The point of contact for information or recommendations regarding this manual should be made to Professor Paul J. Fields, Ph.D., at the Naval Postgraduate School, (408) 656-2456 or e-mail at pjfields@vm1.cc.nps.navy.mil.

APPENDIX. SAMPLE CEA MODEL PRINTOUT

The following appendix pages give a sample of each page of the CEA Model printed output. The pages are: Input Page, Page 1; Standard History Page, Page 2; Current Configuration, Pages 3a and 3b; Proposed Configuration, Pages 4a and 4b; Page 5; Interim Calculations Page, Page 6; Summary Page and Payback Chart.

TITLE: CEA Test Input
ENGINE MODEL: Fwww-xx-yyy   F-zz   CEA VERSION 3.0 11/7/95
TASK/ECP: Task 000   CEA Guru

Sample text which appears on page 5. Line 1
Sample line 2
Sample line 3
Sample line 4
Sample line 5
Sample line 6
Sample line 7
Sample line 8
Sample line 9
Last Line Saved. Line 10

SUMMARY - Delta between current and proposed configurations.
All values shown are THOUSANDS of fiscal year 1993 dollars.

		Cost	Savings
1)	Engineering Development Cost		
2)	Production Engine Cost	$3,500 K	
3)	Operational Engine Modification Cost		$19,818 K
4)	Follow-on Maintenance Material Cost		$2,009,176 K
5)	Follow-on Maintenance Labor Cost		$95,357 K
6)	Publications Cost	$200 K	
7)	Support Equipment Cost	$1,000 K	
8)	Part Number Cost	$201 K	
9)	Operational Fuel Cost		$52,572 K
10)	Aircraft Loss Cost		
	Totals	$4,901 K	$2,176,924 K

Net Delta Dollar Impact	$2,172,023 K
Net Present Value at 10%	$539,592 K

Return on Investment: 87.9   Years to Return Investment: 1.50

ASSUMPTIONS

a)	Incorporation in Production engines will begin in		Oct	1991
b)	Number of engines produced with this change is			175
c)	Number of spare units incorporating this change is			60
d)	Modification of operational engines can begin in		Jan	1995
e)	Incorporation of this change in operational engines will be accomplished by --->	Attrition	at	Depot
f)	Total kits installed out of total engines not modified in production is	125	of	125
g)	Total engines lost to attrition is			0
h)	Total engines retired unmodified is			0
i)	Estimated yearly flying hours	300	EFH / Year	

TITLE: CEA Test Input — CEA VERSION 3.0 — 11/7/95

ENGINE MODEL: Fwww-xx-yyy — F-zz — Pg. 1

TASK/ECP: Task 000

Standard Inputs

Fiscal Year Dollars	1993
NPV Rate	10%
Labor Cost / Manhour at O&I	$37.12
Labor Cost / Manhour at Depot	$49.74
Cost to introduce new P/N - $ / PN	$819
Cost to Maintain each P/N / Year	$135
Fuel Cost / Gallon	$0.75
Test Fuel - Gallons / Hour	150
Flight Fuel - Gallons / Hour	1000
EFH / Year	300
TAC / EFH Ratio	3.00
TOT / EFH Ratio	1.50
Aircraft Cost	$0

Task Incorporation Input

1.0	Incorporation Style: (1,2 or 3)		1
	1 = Attrition		
	2 = Retrofit at 1st Opportunity		
	3 = Forced Retrofit	Kits / Month ——>	0
2.0	Does Kit Cost Replace Normal Maint. Material Cost? 1=Yes 0=No		1
3.0	Delta Production Cost		$20,000
4.0	Kit Hardware Cost - $ / Engine		$20,000
5.0	Kit Labor Manhours at O&I		100
6.0	Kit Labor Manhours at Depot		100
7.0	Technical Pubs Cost - Total $		$100,000
8.0	TCTO/Technical Directives Cost - Total $		$100,000
9.0	Tooling/Support Equipment Cost-Total $		$1,000,000
10.0	Spare Parts Factor		20%
11.0	Scheduled % Events being Modified		100%
12.0	Unscheduled % Events being Modified		100%
13.0	Unscheduled Event Rate allowing Modification		2.000
14.0	Production Incorporation Date	Year ——> 1991	Month ——> 10
15.0	Field Incorporation Date	Year ——> 1995	Month ——> 1

			CURRENT	PROPOSED
Scheduled Input				
16.0	Scheduled Maintenance Interval	Units/EFH= TAC	2150	2150
17.0	Calculated Scheduled Maintenance Interval Rate/1000 EFH		1.395	1.395
18.0	Scheduled Manhours at O level		10.0	5.0
19.0	Scheduled % Removed at O&I level		100%	50%
20.0	Scheduled Manhours to Remove/Replace at O level		100.0	50.0
21.0	Scheduled Manhours at I level		50.0	25.0
22.0	Scheduled % at O&I requiring Repair		100%	50%
23.0	Scheduled Repair Cost at O&I level		$1,000	$1,000
24.0	Scheduled % Returned to Depot		100%	50%
25.0	Scheduled Manhours at Depot		100.0	50.0
26.0	Scheduled % at Depot requiring Repair		100%	50%
27.0	Scheduled Repair Cost at Depot		$80,000	$40,000
28.0	Scheduled % Scrapped		100%	100%
29.0	Hardware Cost to Scrap		$120,000	$10,000
30.0	Scheduled Engine Test Time		5.00	5.00
Unscheduled Input				
31.0	Unscheduled Event Rate/1000 EFH		2.000	2.000
32.0	Unscheduled Manhours at O level		10.0	5.0
33.0	Unscheduled % Removed at O&I level		100%	50%
34.0	Unscheduled Manhours to Remove/Replace at O level		100.0	50.0
35.0	Unscheduled Manhours at I level		50.0	25.0
36.0	Unscheduled % at O&I requiring Repair		100%	50%
37.0	Unscheduled Repair cost at O&I level		$1,000	$1,000
38.0	Unscheduled % Returned to Depot		100%	50%
39.0	Unscheduled Manhours at Depot		100.0	50.0
40.0	Unscheduled % at Depot requiring Repair		100%	50%
41.0	Unscheduled Repair Cost at Depot		$80,000	$40,000
42.0	Unscheduled % Scrapped		100%	100%
43.0	Hardware Cost to Scrap		$120,000	$10,000
44.0	Unscheduled Engine Test Time		5.00	5.00
45.0	Unscheduled Secondary Damage Costs		$200,000	$200,000
46.0	Unscheduled Incidental Costs		$500	$500
47.0	Number of P/N's		30	31
Optional Input				
48.0	% Improvement in Specific Fuel Consumption from Current to Proposed			2%
49.0	Aircraft Loss Rate Improvement / 1,000,000 EFH			1.00
50.0	Engineering Development Cost to be Incurred			

CEA Guru

TITLE: CEA Test Input | STANDARD HISTORY FILE | CEA VERSION 3.0 | 11/7/95
ENGINE MODEL: Fwww-xx-yyy F-zz | Pg. 2
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(B) (N) Calendar Year	(C) (O) No. of Available Mod Months: Production	(D) (P) Field	(E) (Q) Engine Deliveries: Annual	(F) (R) Cumulative	(G) (S) Annual Engine Flight Hours: Fleet	(H) (T) Average per Engine	(I) (U) Attrition: Cumulative Engines	(J) (W) Annual Engines
1988	0	0	0	0	0	300.00	0.00	0
1989	0	0	0	0	0	300.00	0.00	0
1990	0	0	50	50	400	16.00	0.00	0
1991	3	0	100	150	1,500	15.00	0.00	0
1992	12	0	100	250	26,000	130.00	0.00	0
1993	12	0	50	300	82,500	300.00	0.00	0
1994	12	0	0	300	90,000	300.00	0.00	0
1995	12	12	0	300	90,000	300.00	0.00	0
1996	12	12	0	300	90,000	300.00	0.00	0
1997	12	12	0	300	90,000	300.00	0.00	0
1998	12	12	0	300	90,000	300.00	0.00	0
1999	12	12	0	300	90,000	300.00	0.00	0
2000	12	12	0	300	90,000	300.00	0.00	0
2001	12	12	0	300	90,000	300.00	0.00	0
2002	12	12	0	300	90,000	300.00	0.00	0
2003	12	12	0	300	90,000	300.00	0.00	0
2004	12	12	0	300	90,000	300.00	0.00	0
2005	12	12	0	300	90,000	300.00	0.00	0
2006	12	12	0	300	90,000	300.00	0.00	0
2007	12	12	0	300	90,000	300.00	0.00	0
2008	12	12	0	300	90,000	300.00	0.00	0
2009	12	12	0	300	90,000	300.00	0.00	0
2010	12	12	0	300	90,000	300.00	0.00	0
2011	12	12	0	300	90,000	300.00	0.00	0
2012	12	12	0	300	90,000	300.00	0.00	0
2013	12	12	0	300	90,000	300.00	0.00	0
2014	12	12	0	300	90,000	300.00	0.00	0
2015	12	12	0	300	90,000	300.00	0.00	0
2016	12	12	0	300	90,000	300.00	0.00	0
2017	12	12	0	300	90,000	300.00	0.00	0
2018	12	12	0	300	90,000	300.00	0.00	0
2019	12	12	0	300	90,000	300.00	0.00	0
2020	12	12	0	300	90,000	300.00	0.00	0
2021	12	12	0	300	90,000	300.00	0.00	0
2022	12	12	0	300	90,000	300.00	0.00	0
2023	12	12	0	300	90,000	300.00	0.00	0
2024	12	12	0	300	90,000	300.00	0.00	0
2025	12	12	0	300	90,000	300.00	0.00	0
2026	12	12	0	300	90,000	300.00	0.00	0
2027	12	12	0	300	90,000	300.00	0.00	0
2028	12	12	0	300	90,000	300.00	0.00	0
2029	12	12	0	300	90,000	300.00	0.00	0
2030	12	12	0	300	90,000	300.00	0.00	0
2031	12	12	0	300	90,000	300.00	0.00	0
2032	12	12	0	300	90,000	300.00	0.00	0
Totals		Engines Delivered ⇒	300	EFH ⇒	3,620,400			0

EFH / Year =	300	Test Fuel - Gallons / Hour =	150	Attrition / EFH	0.00000	0
TAC / EFH=	3.0	Flight Fuel - Gallons / Hour =	1000			
TOT / EFH=	1.5	Aircraft Cost	$0			

TITLE: CEA Test Input
ENGINE MODEL: Fwww-xx-yyy F-zz
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(B) (BA) Calendar Year	(D) (BC) Avg. No Current Engines	(E) (BD) Engines	(F) (BE) Yearly Engine Current EFH (1000 EFH)	(G) (BF) Flight Hours	(H) (BG) Unsch Current	(I) (BH) Events	(J) (BI) Sched Current	(K) (BJ) Events
1988	0		0.000		0		0.0	
1989	0		0 000		0		0 0	
1990	25		0 400		0 8		0 0	
1991	100		1.500		3		0.0	
1992	200		26 000		52		0 0	
1993	275		82 500		165		0 0	
1994	300		90.000		180		92 0	
1995	300		90.000		180		125.6	
1996	300		90.000		180		125.6	
1997	300		90.000		180		125.6	
1998	300		90.000		180		125.6	
1999	300		90.000		180		125.6	
2000	300		90.000		180		125.6	
2001	300		90.000		180		125.6	
2002	300		90.000		180		125 6	
2003	300		90.000		180		125.6	
2004	300		90.000		180		125 6	
2005	300		90 000		180		125 6	
2006	300		90 000		180		125 6	
2007	300		90 000		180		125 6	
2008	300		90.000		180		125 6	
2009	300		90 000		180		125.6	
2010	300		90.000		180		125.6	
2011	300		90.000		180		125.6	
2012	300		90.000		180		125.6	
2013	300		90.000		180		125.6	
2014	300		90 000		180		125.6	
2015	300		90.000		180		125.6	
2016	300		90.000		180		125.6	
2017	300		90.000		180		125.6	
2018	300		90 000		180		125.6	
2019	300		90 000		180		125 6	
2020	300		90 000		180		125 6	
2021	300		90 000		180		125.6	
2022	300		90 000		180		125.6	
2023	300		90 000		180		125 6	
2024	300		90.000		180		125.6	
2025	300		90.000		180		125.6	
2026	300		90.000		180		125.6	
2027	300		90.000		180		125.6	
2028	300		90.000		180		125.6	
2029	300		90.000		180		125 6	
2030	300		90.000		180		125.6	
2031	300		90.000		180		125.6	
2032	300		90.000		180		125.6	
Totals			3,620.400		7240.8		4864.1	

TITLE: CEA Test Input
ENGINE MODEL: Fwww-xx-yyy F-zz
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CURRENT CONFIGURATION

CEA VERSION 3 0 11/7/95
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(U) (BT) Calendar Year	(V) (BU)	(X) (BW) Part Maint Cost Current $(000)	(AK) (BX)	(Z) (BY) Current Unsch Cost (Minus Kit Instl) Labor $(000)	(AA) (BZ) Current Unsch Cost (Minus Kit Instl) Material $(000)	(AB) (CA) Current Sched Cost (Minus Kit Instl) Labor $(000)	(AC) (CB) Current Sched Cost (Minus Kit Instl) Material $(000)	(AH) (CG) Current Total Cost $(000)	(AI) (CH) Operational Fuel Gal/Yr (000)	(AJ) (CI) Operational Fuel Cost $(000)	(AL) (CK) Total Cost Curr Config w/ Fuel $(000)
1988		$0.00		$0	$0	$0	$0	$0	0	$0	$0
1989		$0.00		$0	$0	$0	$0	$0	0	$0	$0
1990		$4.04		$9	$322	$0	$0	$335	400	$300	$635
1991		$4.04		$33	$1,207	$0	$0	$1,244	1,500	$1,125	$2,369
1992		$4.04		$567	$20,927	$0	$0	$21,498	26,000	$19,500	$40,998
1993		$4.04		$1,801	$66,402	$0	$0	$68,206	82,500	$61,875	$130,081
1994		$4.04		$1,964	$72,438	$1,004	$18,583	$93,993	90,000	$67,500	$161,493
1995		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
1996		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
1997		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
1998		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
1999		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2000		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2001		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2002		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2003		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2004		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2005		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2006		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2007		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2008		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2009		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2010		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2011		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2012		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2013		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2014		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2015		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2016		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2017		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2018		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2019		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2020		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2021		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2022		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2023		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2024		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2025		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2026		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2027		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2028		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2029		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2030		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2031		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
2032		$4.04		$1,964	$72,438	$1,370	$25,359	$101,136	90,000	$67,500	$168,636
Totals		$173.51		$79,020	$2,913,942	$53,083	$982,229	$4,028,448	3,620,400	$2,715,300	$6,743,748
$ (000) / Event used in the above columns				$10 913	$402 434	$10 913	$201 934				

TITLE: CEA Test Input
ENGINE MODEL: Fwww-xx-yyy F-zz
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PROPOSED CONFIGURATION

CEA VERSION 3.0 11/7/95
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(AN) (CM)	(AO) (CN)	(AP) (CO) (AQ) (CP) Avg No Engines		(AR) (CQ) (AS) (CR) Yearly Engine Flight Hours		(AT) (CS) (AU) (CT) Unsch Events		(AV) (CU AW) (CV) Sched Events		(AX) (CW AY) (CX) A/C Loss Events		(AZ) (CY)	(BA) (CZ) (BB) (DA) Engine Kits		(BC) (DB)	(BD) (DC) (BE) (DD) Spare Kits	
Calendar Year	Engines Mod in Prod	Unmod Engines	Mod Engines	Unmod EFH EFH / 1000	Mod EFH EFH / 1000	Unmod	Mod	Unmod	Mod	Cum	Annual	Ed No Installed	Mat'l Cost $(000)	Labor Cost $(000)	No Installed	Mat'l Cost $(000)	Labor Cost $(000)
1988	0	0.0	0.0	0.000	0.000	0.0	0.0	0.0	0.0	0.0	0	0.0	$0	$0	0	$0	$0
1989	0	0.0	0.0	0.000	0.000	0.0	0.0	0.0	0.0	0.0	0	0.0	$0	$0	0	$0	$0
1990	0	25.0	0.0	0.400	0.000	0.8	0.0	0.0	0.0	0.0	0	0.0	$0	$0	0	$0	$0
1991	25	75.0	25.0	1.125	0.375	2.3	0.8	0.0	0.0	0.0	0	0.0	$0	$0	5	$100	$43
1992	100	75.0	125.0	9.750	16.250	19.5	32.5	0.0	0.0	0.0	0	0.0	$0	$0	20	$400	$174
1993	50	100.0	175.0	30.000	52.500	60.0	105.0	0.0	0.0	0.1	0	0.0	$0	$0	10	$200	$87
1994	0	125.0	175.0	37.500	52.500	75.0	105.0	38.3	53.7	0.1	0	0.0	$0	$0	0	$0	$0
1995	0	82.8	217.2	24.846	65.154	49.7	130.3	34.7	90.9	0.2	0	84.4	$1,687	$733	16.872111	$337	$147
1996	0	26.9	273.1	8.078	81.922	16.2	163.8	11.3	114.3	0.3	0	27.4	$549	$238	5.4853858	$110	$48
1997	0	8.8	291.2	2.626	87.374	5.3	174.7	3.7	121.9	0.4	0	8.9	$178	$77	1.7833843	$36	$15
1998	0	2.8	297.2	0.854	89.146	1.7	178.3	1.2	124.4	0.4	0	2.9	$58	$25	0.579806	$12	$5
1999	0	0.9	299.1	0.278	89.722	0.6	179.4	0.4	125.2	0.5	0	0.9	$19	$8	0.188504	$4	$2
2000	0	0.3	299.7	0.090	89.910	0.2	179.8	0.1	125.5	0.6	0	0.3	$6	$3	0.0612856	$1	$1
2001	0	0.1	299.9	0.029	89.971	0.1	179.9	0.0	125.5	0.7	0	0.1	$2	$1	0.0199249	$0	$0
2002	0	0.0	300.0	0.010	89.990	0.0	180.0	0.0	125.6	0.8	0	0.0	$1	$0	0.0064779	$0	$0
2003	0	0.0	300.0	0.003	89.997	0.0	180.0	0.0	125.6	0.9	0	0.0	$0	$0	0.0021061	$0	$0
2004	0	0.0	300.0	0.001	89.999	0.0	180.0	0.0	125.6	1.0	0	0.0	$0	$0	0.0006847	$0	$0
2005	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.1	1	0.0	$0	$0	0.0002226	$0	$0
2006	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.2	0	0.0	$0	$0	7.237E-05	$0	$0
2007	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.3	0	0.0	$0	$0	2.353E-05	$0	$0
2008	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.3	0	0.0	$0	$0	7.65E-06	$0	$0
2009	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.4	0	0.0	$0	$0	2.487E-06	$0	$0
2010	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.5	0	0.0	$0	$0	8.086E-07	$0	$0
2011	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.6	0	0.0	$0	$0	2.629E-07	$0	$0
2012	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.7	0	0.0	$0	$0	8.547E-08	$0	$0
2013	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.8	0	0.0	$0	$0	2.779E-08	$0	$0
2014	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	1.9	0	0.0	$0	$0	9.034E-09	$0	$0
2015	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.0	0	0.0	$0	$0	2.937E-09	$0	$0
2016	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.1	1	0.0	$0	$0	9.549E-10	$0	$0
2017	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.2	0	0.0	$0	$0	3.105E-10	$0	$0
2018	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.2	0	0.0	$0	$0	1.009E-10	$0	$0
2019	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.3	0	0.0	$0	$0	3.282E-11	$0	$0
2020	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.4	0	0.0	$0	$0	1.067E-11	$0	$0
2021	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.5	0	0.0	$0	$0	3.469E-12	$0	$0
2022	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.6	0	0.0	$0	$0	1.128E-12	$0	$0
2023	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.7	0	0.0	$0	$0	3.666E-13	$0	$0
2024	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.8	0	0.0	$0	$0	1.192E-13	$0	$0
2025	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	2.9	0	0.0	$0	$0	3.875E-14	$0	$0
2026	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.0	0	0.0	$0	$0	1.26E-14	$0	$0
2027	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.1	1	0.0	$0	$0	4.096E-15	$0	$0
2028	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.1	0	0.0	$0	$0	1.332E-15	$0	$0
2029	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.2	0	0.0	$0	$0	4.33E-16	$0	$0
2030	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.3	0	0.0	$0	$0	1.408E-16	$0	$0
2031	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.4	0	0.0	$0	$0	4.576E-17	$0	$0
2032	0	0.0	300.0	0.000	90.000	0.0	180.0	0.0	125.6	3.5	0	0.0	$0	$0	1.488E-17	$0	$0
Sub Totals	175			115 590	3,504.810	231.18	7009.6	89.7	4774.4		3	125	$2,500	$1,086	60	$1,200	$521
Combined Unmodified & Modified Totals				3620.4		7240.8		4864.1									

	Total	$(000) / Kit
Kits Installed	185	"N/A"
Kit Material Cost	$3,700	$20 000
Kit Labor Cost	$1,607	$8 686

TITLE: CEA Test Input
ENGINE MODEL: Fwww-xx-yyy F-zz
TASK/ECP: Task 000

PROPOSED CONFIGURATION

CEA VERSION 3.0 11/7/95
Pg 4b

(BG) (DF)	(BH) (DG)	(BI) (DH)	(BJ) (DI)	(BK) (DJ)	(BL) (DK)	(BM) (DL)	(BN) (DM)	(BO) (DN)	(BP) (DO)	(BQ) (DP)	(BR) (DQ)	(BS) (DR)	(BT) (DS)	(BU) (DT)	(BV) (DU)	(BW) (DV)	(BX) (DW)
			Part Maint Cost		Unmod Unsch Cost (Minus Kit Instl)		Unmod Sched Cost (Minus Kit Instl)		Mod Unsched Cost		Mod Sched Cost			Operational Fuel			
Calendar Year	One-Time Costs $(000)	Delta Prod Cost $(000)	Unmod $(000)	Mod $(000)	Labor $(000)	Material $(000)	Labor $(000)	Material $(000)	Labor $(000)	Material $(000)	Labor $(000)	Material $(000)	Proposed Total Cost $(000)	Gal/Yr (000)	Cost $(000)	A/C Loss Delta $(000)	Total Cost Prop Config w/ Fuel,A/C $(000)
1988	$0	$0	$0.00	$0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	0	$0	$0	$0
1989	$0	$0	$0.00	$0.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	0	$0	$0	$0
1990	$0	$0	$4.04	$0.00	$9	$322	$0	$0	$0	$0	$0	$0	$335	400	$300	$0	$635
1991	$1,225	$500	$4.04	$4.17	$25	$905	$0	$0	$2	$174	$0	$0	$2,983	1,493	$1,119	$0	$4,102
1992	$0	$2,000	$4.04	$4.17	$213	$7,847	$0	$0	$92	$7,538	$0	$0	$18,272	25,675	$19,256	$0	$37,528
1993	$0	$1,000	$4.04	$4.17	$655	$24,146	$0	$0	$296	$24,353	$0	$0	$50,745	81,450	$61,088	$0	$111,833
1994	$0	$0	$4.04	$4.17	$818	$30,183	$418	$7,743	$296	$24,353	$151	$1,687	$65,658	88,950	$66,713	$0	$132,371
1995	$0	$0	$4.04	$4.17	$542	$10,010	$378	$32	$368	$30,223	$256	$2,858	$47,579	88,697	$66,523	$0	$114,102
1996	$0	$0	$4.04	$4.17	$176	$3,254	$123	$11	$462	$38,001	$322	$3,593	$46,895	88,362	$66,271	$0	$113,167
1997	$0	$0	$4.04	$4.17	$57	$1,058	$40	$3	$493	$40,530	$344	$3,832	$46,673	88,253	$66,189	$0	$112,862
1998	$0	$0	$4.04	$4.17	$19	$344	$13	$1	$503	$41,352	$351	$3,910	$46,601	88,217	$66,163	$0	$112,763
1999	$0	$0	$4.04	$4.17	$6	$112	$4	$0	$506	$41,619	$353	$3,935	$46,577	88,206	$66,154	$0	$112,731
2000	$0	$0	$4.04	$4.17	$2	$36	$1	$0	$507	$41,706	$354	$3,944	$46,570	88,202	$66,151	$0	$112,721
2001	$0	$0	$4.04	$4.17	$1	$12	$0	$0	$508	$41,734	$354	$3,946	$46,567	88,201	$66,150	$0	$112,717
2002	$0	$0	$4.04	$4.17	$0	$4	$0	$0	$508	$41,744	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2003	$0	$0	$4.04	$4.17	$0	$1	$0	$0	$508	$41,747	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2004	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2005	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2006	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2007	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2008	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2009	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2010	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2011	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2012	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2013	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2014	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2015	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2016	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2017	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2018	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2019	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2020	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2021	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2022	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2023	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2024	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2025	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2026	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2027	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2028	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2029	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2030	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2031	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
2032	$0	$0	$4.04	$4.17	$0	$0	$0	$0	$508	$41,748	$354	$3,947	$46,566	88,200	$66,150	$0	$112,716
Sub Totals	$1,225	$3,500	$173.51	$175.12	$2,523	$78,235	$979	$7,791	$19,775	########	$13,469	$150,077	########	3,550,304	$2,662,728	$0	$4,571,725
Combined Unmodified & Modified Totals			$348.62			$80,758		$8,770		########		$163,546					
$ (000) / Event used in the above columns:					$10 913	$402 434	$10 913	$201 934	$2 821	$231 934	$2 821	$31 434					

TITLE: CEA Test Input | CEA VERSION 3.0 | 11/7/95
ENGINE MODEL: Fwww-xx-yyy | F-zz | Pg. 5
TASK/ECP: Task 000

(B) (DY) CAL. YEAR	(C) (DZ) Expenditures Current $(000)	(D) (EA) Expenditures Proposed $(000)	(E) (EB) Delta Cashflow Yearly Savings $(000)	(F) (EC) Delta Cashflow Cumulative Savings $(000)	(G) (ED) Cumulative NPV at 10% $(000)
1988	$0	$0	$0	$0	$0
1989	$0	$0	$0	$0	$0
1990	$635	$635	$0	$0	$0
1991	$2,369	$4,102	($1,733)	($1,733)	($2,097)
1992	$40,998	$37,528	$3,470	$1,737	$1,720
1993	$130,081	$111,833	$18,249	$19,985	$19,968
1994	$161,493	$132,371	$29,122	$49,108	$46,443
1995	$168,636	$114,102	$54,534	$103,642	$91,513
1996	$168,636	$113,167	$55,470	$159,111	$133,188
1997	$168,636	$112,862	$55,774	$214,885	$171,282
1998	$168,636	$112,763	$55,873	$270,758	$205,974
1999	$168,636	$112,731	$55,905	$326,662	$237,531
2000	$168,636	$112,721	$55,915	$382,578	$266,224
2001	$168,636	$112,717	$55,919	$438,496	$292,311
2002	$168,636	$112,716	$55,920	$494,416	$316,026
2003	$168,636	$112,716	$55,920	$550,336	$337,586
2004	$168,636	$112,716	$55,920	$606,256	$357,186
2005	$168,636	$112,716	$55,920	$662,176	$375,004
2006	$168,636	$112,716	$55,920	$718,097	$391,202
2007	$168,636	$112,716	$55,920	$774,017	$405,927
2008	$168,636	$112,716	$55,920	$829,937	$419,314
2009	$168,636	$112,716	$55,920	$885,857	$431,484
2010	$168,636	$112,716	$55,920	$941,778	$442,547
2011	$168,636	$112,716	$55,920	$997,698	$452,605
2012	$168,636	$112,716	$55,920	$1,053,618	$461,749
2013	$168,636	$112,716	$55,920	$1,109,538	$470,061
2014	$168,636	$112,716	$55,920	$1,165,459	$477,617
2015	$168,636	$112,716	$55,920	$1,221,379	$484,487
2016	$168,636	$112,716	$55,920	$1,277,299	$490,732
2017	$168,636	$112,716	$55,920	$1,333,219	$496,409
2018	$168,636	$112,716	$55,920	$1,389,140	$501,571
2019	$168,636	$112,716	$55,920	$1,445,060	$506,263
2020	$168,636	$112,716	$55,920	$1,500,980	$510,528
2021	$168,636	$112,716	$55,920	$1,556,900	$514,406
2022	$168,636	$112,716	$55,920	$1,612,821	$517,931
2023	$168,636	$112,716	$55,920	$1,668,741	$521,136
2024	$168,636	$112,716	$55,920	$1,724,661	$524,049
2025	$168,636	$112,716	$55,920	$1,780,581	$526,698
2026	$168,636	$112,716	$55,920	$1,836,502	$529,105
2027	$168,636	$112,716	$55,920	$1,892,422	$531,294
2028	$168,636	$112,716	$55,920	$1,948,342	$533,284
2029	$168,636	$112,716	$55,920	$2,004,262	$535,093
2030	$168,636	$112,716	$55,920	$2,060,183	$536,738
2031	$168,636	$112,716	$55,920	$2,116,103	$538,233
2032	$168,636	$112,716	$55,920	$2,172,023	$539,592
Totals	$6,743,748	$4,571,725	$2,172,023		
NPV	$1,817,772	$1,278,180	$539,592		

Base Year is 1993
NPV Rate 10%

TITLE: CEA Test Input		*Interim Calculations*	CEA VERSION 3.0	11/7/95
ENGINE MODEL: Fwww-xx-yyy	F-zz			
TASK/ECP: Task 000				

(A)	Delta Production Cost	$20,000.00	(D)	Publications Cost	$200,000.00
(B)	Kit Cost	$20,000.00	(E)	Support Equipment	$1,000,000.00
(C)	Labor Cost to Install the Kit	$8,686.00	(F)	Aircraft Cost	$0.00

	Modification Events	*Unscheduled*	*Scheduled*	*Spares*	*Total*
(G)	Engines Modified in Production				175
(H)	Retrofit Events	74	51	60	185

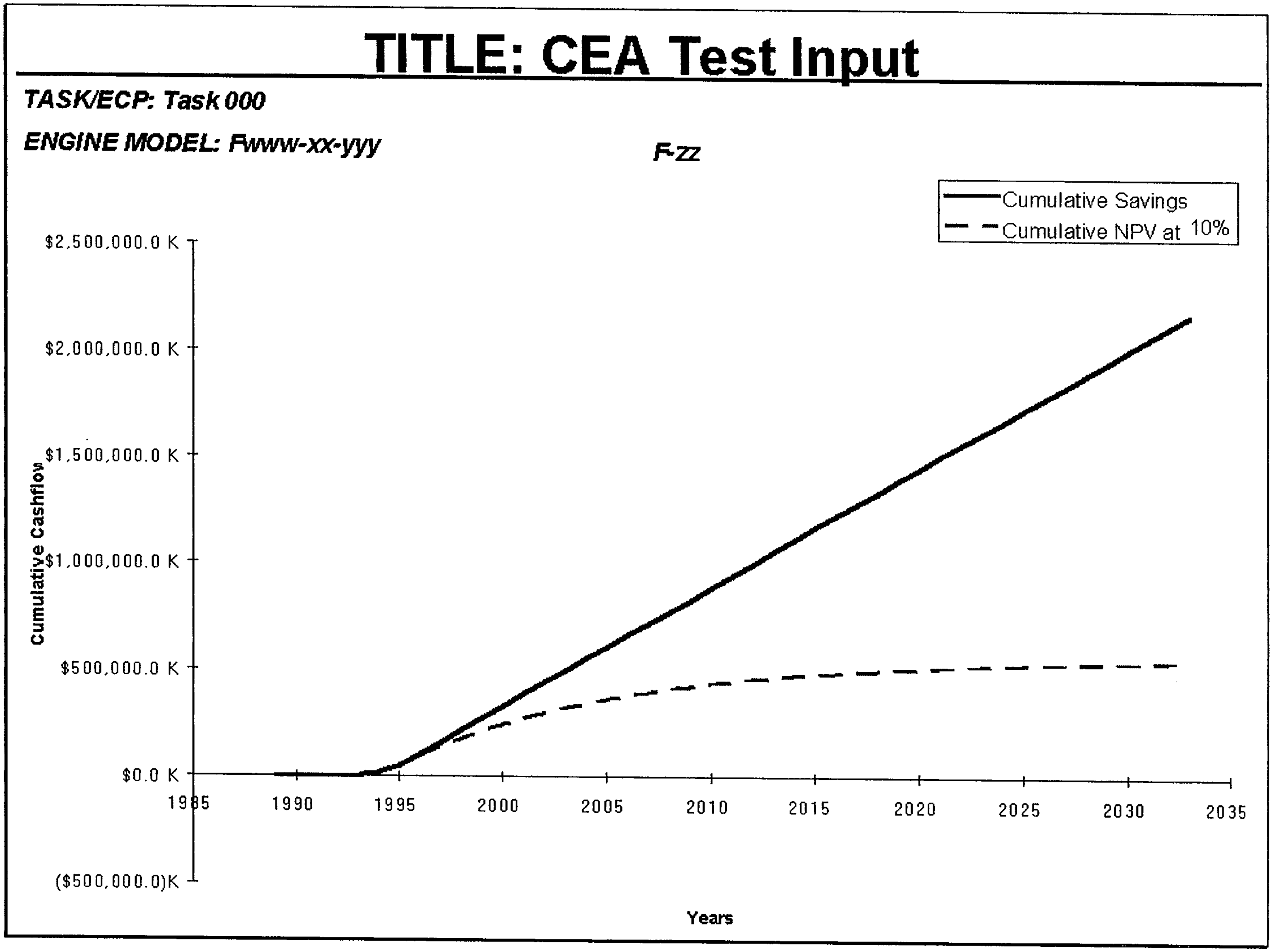
			Proposed	
	Operational Events & EFH	*Current*	*Unmod*	*Mod*
(J)	Scheduled Events	4864.1	89.7	4774.4
(K)	Unscheduled Events	7240.8	231.2	7009.6
(L)	Engine Flight Hours (In Thousands)	3,620.400	115.590	3,504.810
(M)	Aircraft Losses Delta	N/A	N/A	3

			Proposed		*Equations to Calculate Cost/Evt*
	Scheduled Costs / Event	*Current*	*Unmod*	*Mod*	*Numbers (xx.0) Reference Input Page*
	O & I Labor	$5,939.20	$5,939.20	$1,577.60	(18.0 + (19.0 * (20.0 + 21.0))) * BLR
	Depot Labor	$4,974.00	$4,974.00	$1,243.50	(24.0 * 25.0) * DLR
(N)	Total Labor	$10,913.20	$10,913.20	$2,821.10	
	O & I Repair	$1,000.00	$1,000.00	$500.00	(22.0 * 23.0)
	Depot Repair	$80,000.00	$80,000.00	$20,000.00	(26.0 * 27.0)
	Scrap Cost	$120,000.00	$120,000.00	$10,000.00	(28.0 * 29.0)
(P)	Total Material	$201,000.00	$201,000.00	$30,500.00	
	Test Labor & Fuel	$933.70	$933.70	$933.70	(30.0 * G17 * G19) + (30.0 * 2 * BLR)
(Q)	Total Material Incl Test	$201,933.70	$201,933.70	$31,433.70	

			Proposed		*Equations to Calculate Cost/Evt*
	Unscheduled Costs / Event	*Current*	*Unmod*	*Mod*	*Numbers (xx.0) Reference Input Page*
	O & I Labor	$5,939.20	$5,939.20	$1,577.60	(32.0 + (33.0 * (34.0 + 35.0))) * BLR
	Depot Labor	$4,974.00	$4,974.00	$1,243.50	(38.0 * 39.0) * DLR
(R)	Total Labor	$10,913.20	$10,913.20	$2,821.10	
	O & I Repair	$1,000.00	$1,000.00	$500.00	(36.0 * 37.0)
	Depot Repair	$80,000.00	$80,000.00	$20,000.00	(40.0 * 41.0)
	Scrap	$120,000.00	$120,000.00	$10,000.00	(42.0 * 43.0)
(S)	Total Material	$201,000.00	$201,000.00	$30,500.00	
	Test Labor & Fuel	$933.70	$933.70	$933.70	(44.0 * G17 * G19) + (44.0 * 2 * BLR)
(T)	Total Material Incl Test	$201,933.70	$201,933.70	$31,433.70	
	Second Damage & Incidental	$200,500.00	$200,500.00	$200,500.00	(45.0 + 46.0)
(U)	GrandTotal Material	$402,433.70	$402,433.70	$231,933.70	

Summary Page Equations

1)	Engineering Development Cost	(InputIF68)
2)	Production Engine Cost	(A * G)
3)	Operational Engine Modification Cost	(H_Total * (B + C) - (H_Unsch * S + H_Sch * P))
4)	Follow-on Maintenance Material Cost	((K_Cur * U_Cur + J_Cur *Q_Cur) - (K_ProUnmod * U_ProUnmod + J_ProUnmod * Q_ProUnmod + K_ProMod * U_ProMod + J_ ProMod * Q_ProMod))
5)	Follow-on Maintenance Labor Cost	((K_Cur * R_Cur + J_Cur * N_Cur) - (K_ProUnmod * R_ProUnmod + J_ProUnmod * N_ProUnmod + K_ProMod * R_ProMod + J_ProMod * N_ProMod))
6)	Publications Cost	(D)
7)	Support Equipment Cost	(E)


TITLE: CEA Test Input
TASK/ECP: Task 000
ENGINE MODEL: Fwww-xx-yyy
F-zz
Cumulative Savings
Cumulative NPV at 10%
Cumulative Cashflow
$2,500,000.0 K
$2,000,000.0 K
$1,500,000.0 K
$1,000,000.0 K
$500,000.0 K
$0.0 K
($500,000.0)K
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
Years

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