

EPC Value Model – Aerospace & Defense Value Model Manual

EPCglobal US
Eindhoven University of Technology
Stanford University



Published 2006 Version 1.0

©2006 EPCglobal US™

Disclaimer

EPCglobal US™, Stanford University, Eindhoven University of Technology, and all participating companies (hereinafter collectively referred to as “Companies”) make no representations or warranties, express or implied of any kind, including merchantability or fitness for a particular purpose or use, of the EPC Value Model or any data or results derived there from. COMPANIES SHALL NOT BE LIABLE FOR DAMAGES OF ANY TYPE, INCLUDING INCIDENTAL, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES, EITHER IN CONTRACT OR TORT, INCLUDING BUT NOT LIMITED TO NEGLIGENCE, ARISING OUT OF OR CONNECTED WITH THE PROVISION OR USE OF THE EPC VALUE MODEL.

Table of Contents

Introduction	4
Supply Chain Structure	4
Instructions Regarding the EPC/RFID Benefits Model	5
Preliminary Information Sheet	5
Summary Sheet	5
Cost Sheet	5
Business Issue / Driver Sheets	5
1. Preliminary Information	6
IMPROVE MONITORING OF PARTS' LOCATION	6
2. Summary	7
3. Costs	8
4. Business Issue: Out of Stock	10
5. Business Issue: Traceability	13
6. Business Issue: Asset Management	15
7. Business Issue: Unapproved parts	17
8. Business Issue: Unscheduled Maintenance	19
9. Business Issue: Rework & Scrap	21
10. Business Issue: Errors Reading/Writing Part Codes Data	23
11. Business Driver: Trackability	25
12. Business Driver: Returnable Assets	27
13. Business Driver: Manual Administrative Processes	29
14. Business Driver: Inbound - Outbound	31

Introduction

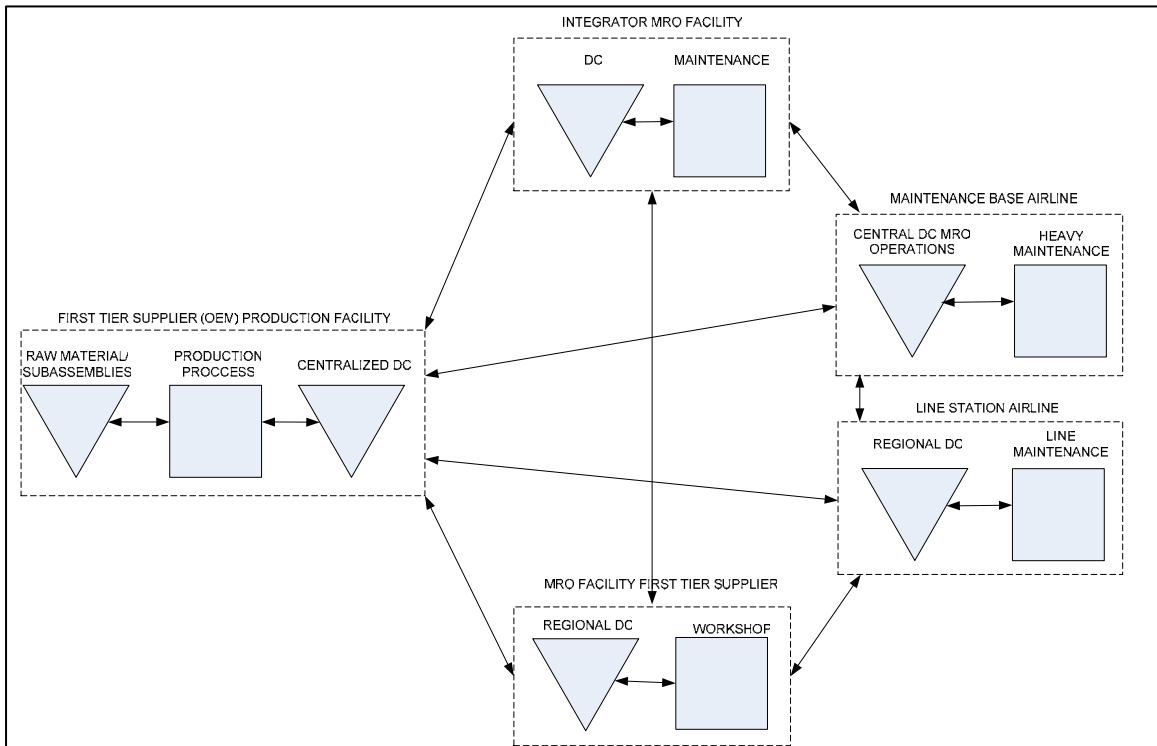
This EPC Value Model is designed to help *aerospace and defense (A&D) maintenance, repair, and overhaul (MRO) companies* assess their expected benefits from EPC/RFID global standards implementations within their internal organizations, their trading partner network and overall supply chain. This model is best suitable for the following types of businesses:

- MRO operations and/or production of 1st tier suppliers
- MRO operations of airlines
- MRO operations of integrators (airline manufacturers)

Built upon on inputs from leading A&D supply chain members who participated throughout 2006 in a study, this workbook was constructed jointly by the Stanford Global Supply Chain Management Forum and the Eindhoven University of Technology, and was sponsored by EPCglobal US. For comments or suggestions regarding the Model, please email rceleste@epcglobalus.org

Supply Chain Structure

An underlying assumption of the Model is that the supply chain under consideration has the following structures:



Instructions Regarding the EPC/RFID Benefits Model

This Model consists of 15 separate worksheets. Cells marked in *gray* require user inputs. Other data cells are calculations based on user input. Assumptions made in any sheet, if any, are mentioned in the respective worksheets.

Preliminary Information Sheet

In this sheet users are asked to provide basic business information, including total annual revenues, profit margin, annual cost of capital, etc. In addition, the sheet provides a list of all the business drivers identified as those that can potentially be improved with the use of EPC/RFID. Users are asked to select those business drivers / business issues that are relevant for their organizations.

Summary Sheet

This sheet gives the overall summary of the Model, including the expected benefits, costs, as well as the net present value (NPV) of the EPC/RFID initiative over a 5-year planning horizon. The list of benefits includes business issues that EPC/RFID may help to mitigate as well as business drivers that EPC/RFID may help to enhance. Summarizing benefits in this way allows users to identify the contribution of EPC/RFID for each individual business issue / driver and might assist firms in prioritizing the areas to implement EPC/RFID. Two types of key benefits of EPC/RFID implementation are taken into consideration in this Model: added revenues and cost reduction. These benefits are calculated quantitatively in the Summary sheet. The Summary sheet also lists the annual costs associated with EPC/RFID implementation.






Cost Sheet

This sheet computes, based on user input, the total one-time and recurring costs for manufacturers for implementing RFID solutions in each of the five years in the Model's planning horizon. The sheet takes into account costs that are incurred at all the manufacturer's production facilities and warehouses.

Business Issue / Driver Sheets

Each of the remaining sheets calculates in detail the value of EPC/RFID for each of the business issues / business drivers. Each sheet includes default values for the expected impacts of EPC/RFID. Users should change these default values as needed, to fit to the characteristics of their own organizations. Out of the total worksheets available, the Model will present only those sheets that are relevant to the users, based on their selection in the Preliminary Information sheet. The information in the Summary sheet is based on the detailed calculations in the Business Issue / Driver sheets.

Color Coding Used in the Sheets

	-User Input (users are requested to enter data here)
	-Higher and Sub-level Summary
	-Result/Summary
	-Title of the worksheet
	-Part of the supply chain the calculations relate

1. Preliminary Information

The user will be prompted to fill-in general information about their company in the worksheet marked “**Preliminary Information**”. This information will be used to calculate probable results.

Please enter below the preliminary information about your company		
GENERAL		
	Current annual revenues	\$100,000,000
	% Margin (Profit)	20%
	Expected annual business growth rate	10%
	Annual cost of capital	10%
	Average inventory as % of revenues	15%
	% of total inventory dedicated as safety stock	30%

Then the user will be asked to check business areas that they would like to evaluate using the planning Models. The options to check are grouped into two categories – Business Issues, which are known problems for a large number of manufacturers and can potentially be reduced through EPC/RFID implementation. This area has six worksheets and is marked in red. The second category is Business Drivers, which includes those capabilities that manufacturers can potentially enhance through EPC/RFID implementation. This area has four worksheets and is marked in blue.

✓	OUT-OF-STOCK	Business Issues
✓	IMPROPER MONITORING PARTS' HISTORY	
✓	INEFFICIENT ASSET MANAGEMENT	
✓	UNAPPROVED PARTS	
✓	UNSCHEDULED MAINTENANCE TASKS	
✓	REWORK/SCRAP	
✓	ERRORS IN READING / WRITING PART CODES	
✓	IMPROVE MONITORING OF PARTS' LOCATION	Business Drivers
✓	IMPROVE RETURNABLE ASSET MANAGEMENT	
✓	REDUCE MANUAL ADMINISTRATIVE PROCESSES	
✓	IMPROVE INBOUND / OUTBOUND	

2. Summary

This worksheet is the RESULT of the calculations conducted in the individual worksheets based on inputs from the user. It is located at the front of the EPC Value Model so the user can reference inputs and the impact on the total picture. The worksheet is a total of the business issues and drivers worksheets that the user selected. The first part of the worksheet presents a summary of the expected added revenues, added profit, and reduced costs for Year 5 of the planning horizon, when it is assumed that EPC/RFID will already be fully implemented across the manufacturer's entire manufacturing and warehouse facilities. In addition, this part of the worksheet shows the expected one-time benefits in Year 1.

Double counting in overlap areas such as risk management, inventory management, and increasing transportation costs. Users can go to the individual cells and see the specific overlap areas for revenues and reduced cost.

SUMMARY: EXPECTED BENEFITS AND COSTS OF EPC/RFID IMPLEMENTATION

Year 5 (100% implementation) benefits:

BENEFITS	Added Revenues	Added Profit	Reduced Cost
ANNUALLY RECURRING BENEFITS			
REDUCE OUT-OF-STOCK	\$617,850	\$77,304	\$1,694,858
IMPROPER MONITORING PARTS' HISTORY	\$20,000	\$0	\$2,844,662
INEFFICIENT ASSET MANAGEMENT	\$0	\$0	\$2,836,403
UNAPPROVED PARTS	\$60,000	\$0	\$1,084,870
UNSCHEDULED MAINTENANCE TASKS	\$0	\$0	\$1,970,510
REWORK/SCRAP	\$40,000	\$0	\$2,159,933
ERRORS IN READING / WRITING PART CODES	\$0	\$0	\$1,862,664
IMPROVE MONITORING OF PARTS' LOCATION	\$120,000	\$0	\$2,935,380
IMPROVE RETURNABLE ASSET MANAGEMENT	\$0	\$0	\$2,156,535
REDUCE MANUAL ADMINISTRATIVE PROCESSES	\$0	\$0	\$2,283,996
IMPROVE INBOUND / OUTBOUND	\$0	\$0	\$2,320,843
TOTAL YEAR 5 BENEFITS (INCLUDING DOUBLE COUNTING)	\$857,850	\$77,304	\$24,150,653
ADJUSTMENT FOR DOUBLE COUNTING	\$0	\$0	\$8,539,132
TOTAL YEAR 5 BENEFITS	\$857,850	\$77,304	\$15,611,521

In the second part of the worksheet, Net Present Value (NPV) is calculated over a 5-year planning horizon based upon the expected additional annual revenue and profit from EPC/RFID the expected annual cost reductions, as well as the expected annual costs for EPC/RFID implementation. The Net Benefit is derived by summing the total benefits and subtracting the costs. The discounted benefit is calculated by factoring in the cost of capital against the net benefit. The Model calculates all of this for the user.

NPV	Year 1	Year 2	Year 3	Year 4	Year 5
Additional annual revenues due to EPC/RFID	\$117,185	\$257,806	\$425,380	\$623,891	\$857,850
Additional annual profit due to higher revenues (Margin*Add. Rev)/(1+ Margin)	\$19,531	\$42,968	\$70,897	\$103,982	\$142,975
Additional annual profits directly through EPC/RFID	\$10,560	\$23,232	\$38,333	\$56,221	\$77,304
Benefit due to reduction in costs	\$2,132,576	\$4,691,667	\$7,741,250	\$11,353,834	\$15,611,521
RFID/EPC related costs	\$3,280,000	\$6,690,000	\$7,470,000	\$10,680,000	\$13,240,000
Net Benefit using EPC/RFID	\$1,000,149	(\$1,674,327)	\$805,860	\$1,457,928	\$3,449,651
Discounted benefit	(\$1,000,149)	(\$1,522,116)	\$666,000	\$1,095,363	\$2,356,158
5-year discounted NPV		\$1,595,256			

3. Costs

This important source sheet is where the user will tailor the Model to both factory and warehouse implementation ramp over a 5-year period. The user may wish to refer to the example spreadsheet, which can provide a starting point.

Step 1: Users should enter the company's total number of factories and warehouses in the gray cells.

Total Number of Production Facilities (Factories)	8
Total Number of Warehouses	5

Step 2: Next, the user will input the percentage ramp expected for EPC/RFID adoption over the 5-year period. The Model assumes at the end of the 5th year, the factories are in full production at 100 percent with the EPC/RFID technology.

	Year 1	Year 2	Year 3	Year 4	Year 5
Percentage of Business using EPC/RFID	20.00%	40.00%	60.00%	80.00%	100.00%

Step 3: Next, the user is asked to provide information separately for the expected implementation costs at the manufacturer's production facilities. In the **"Factories"** part of the worksheet, the user should first input the total number of production facilities that are expected to have EPC/RFID technology implemented in them in each of the 5 years. The Model will calculate the percentage of factories with EPC/RFID based upon the **"Percentage of factories with EPC/RFID"** and **"Number of MRO/production facilities"**.

The factories' costs are based upon one-time start-up costs, and recurring costs. The one-time cost includes hardware, software, consulting, infrastructure charges, and internal project teams. These costs add up to a fixed cost for each production facility. Variable costs include tags, which may change overtime due to price reductions, annual maintenance, labor, and additional costing for readers, as well as training costs.

The user should enter the expected costs per production facility in the "Year" columns and associated **"One-time average cost per MRO/production facility"** and **"Variable cost per MRO/production facility"** rows.

	Year 1	Year 2	Year 3	Year 4	Year 5
Number of MRO/production facilities	1	3	4	6	8
Percentage of factories with EPC/RFID	12.50%	37.50%	50.00%	75.00%	100.00%
One-time average cost per MRO/production facility:					
Hardware expense (Including readers)	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
Software expense	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
Consulting and systems Integration	\$200,000	\$200,000	\$150,000	\$100,000	\$100,000
Other infrastructure change expense (for readability of tags etc)	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Internal project teams	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
Fixed cost of EPC/RFID for manufacturer's MRO/production facilities	\$850,000	\$1,700,000	\$800,000	\$1,500,000	\$1,500,000
Variable cost per MRO/production facility:					
Total annual cost of tags used for production tracking	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000
Total annual maintenance costs	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Additional mfg. floor labor (Number * annual pay)	\$180,000	\$180,000	\$180,000	\$180,000	\$180,000
Annual cost of readers	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Training and other costs	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Per facility annual variable cost of EPC/RFID (sum of the above)	\$830,000	\$830,000	\$830,000	\$830,000	\$830,000
Total variable cost of EPC/RFID for manufacturer's MRO/production facilities	\$830,000	\$2,490,000	\$3,320,000	\$4,980,000	\$6,640,000

Step 4: Next, Next, the user is asked to provide information separately for the expected implementation costs at the manufacturer’s production facilities. In the “Warehouses” part of the worksheet, the user should first input the total number of warehouse facilities that are expected to have EPC/RFID technology implemented in them in each of the 5 years. The Model will calculate the percentage of factories with EPC/RFID based upon the “Percentage of warehouses with EPC/RFID” and “Number of warehouses”.

The warehouses’ costs are based upon one-time start-up costs, and recurring costs. The one-time cost includes hardware, software, consulting, infrastructure charges, and internal project teams. These costs add up to a fixed cost for each production facility. Variable costs include tags, which may change overtime due to price reductions, annual maintenance, labor, and additional costing for readers, as well as training costs.

The user should enter the expected costs per production facility in the “Year” columns and associated “One-time average cost per warehouse” and “Recurring average cost per warehouse” rows.

	Year 1	Year 2	Year 3	Year 4	Year 5
Number of warehouses	1	2	3	4	5
Percentage of warehouses with RFID/EPC	20.00%	40.00%	60.00%	80.00%	100.00%
One-time average cost per warehouse:					
Hardware expense (Including readers)	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
Software expense	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Consulting and Systems Integration	\$200,000	\$200,000	\$150,000	\$100,000	\$100,000
Other infrastructure change expense (for readability of tags etc)	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Internal project teams	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
Total Fixed cost of RFID for manufacturer’s warehouses	\$700,000	\$700,000	\$650,000	\$600,000	\$600,000
Recurring average cost per warehouse:					
Total annual cost of tags	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000
Maintenance costs per year	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Additional warehouse labor (Number * annual pay)	\$250,000	\$250,000	\$250,000	\$250,000	\$250,000
Annual cost of readers	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Training and other costs	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Per facility annual variable cost of RFID/EPC	\$900,000	\$900,000	\$900,000	\$900,000	\$900,000
Total Variable cost of RFID/EPC for manufacturer’s warehouses	\$900,000	\$1,800,000	\$2,700,000	\$3,600,000	\$4,500,000

Results: The Model will then multiply the cost per facility by the number of facilities with EPC/RFID implementation to determine total expected fixed and variable costs for each year and provides a summary of costs.

	Year 1	Year 2	Year 3	Year 4	Year 5
TOTAL COST	\$3,280,000	\$6,690,000	\$7,470,000	\$10,680,000	\$13,240,000

Spreadsheet Notes:

1. It is assumed that the company gradually adopts the EPC/RFID technology across the different facilities, each time fully implement the technology within an entire facility and then expanding the adoption to additional facilities.
2. The “Percentage of MRO/production with EPC/RFID” information is used by the Model in the Summary worksheet, to determine what portion of the potential benefits across the entire business will be realized each year. The “Number of MRO/production facilities” is used to determine total costs per year. Therefore it is important that users enter both these pieces of data.

4. Business Issue: Out of Stock

Definition: An out of stock (OOS) occurs when there is no stock available on the shelf to fulfill customer demand (only applicable to parts held on stock). The term ‘Stock’ here is only mentioning the finished products that are produced in advance and can be set aside for the use of MRO purposes. In the manufacturer (OEM) point of view, they are products that can be shipped directly to the customers without delay. The lead time here is only the order processing time and the shipping time, which is considered under normal conditions instead of expedition. For MRO service providers, the stock is typically referring to the products that are stored in their warehouse for routine use. EPC/RFID implementation may lead to higher revenues and added profits since it might reduce the amount of lost sales.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to OOS situations (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to OOS situations (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to OOS situations (as % of revenues)	4.00%	\$5,856,400

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of out of stock situations**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of out of stock situations	Percentage		Max. % reduction through EPC/RFID
Unpredictable environment	%	10.00%	
High number of unscheduled maintenance events	50.00%		0.00%
Unreliable (internal) suppliers	50.00%		0.00%
Improper planning	%	20.00%	
Improper scheduling of maintenance	10.00%		10.00%
Inaccurate Spare parts demand forecasting	60.00%		10.00%
Improper production planning	30.00%		10.00%
Inaccuracies in inventory management system	%	15.00%	
Theft	20.00%		70.00%
Inaccurate physical counting of inventory	70.00%		80.00%
Quality issues	10.00%		10.00%
Product reached the end of its usable life cycle	%	5.00%	90.00%
Others	%	50.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Out of stock situations due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to OOS situations (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Out of stock situations due to this cause**”.

“**Expected out of stock situations after EPC/RFID**” is calculated by the Model by multiplying “**Out of stock situations due to this cause**” times 1 minus “**Max % reduction expected through EPC/RFID**”.

“**Added Revenue**” is arrived at by the Model through the subtracting “**Expected out of stock situations after EPC/RFID**” from “**Out of stock situations due to this cause**” and then the result is multiplied by “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

“**Added Profit**” is calculated by the Model by subtracting “**Expected out of stock situations after EPC/RFID**” from “**Out of stock situations due to this cause**” and then the result is multiplied by “**Extrapolated year 5 revenues (100% EPC/RFID)**” times the profit margin, which is sourced from the “**Preliminary Information**” worksheet.

“**Reduced Costs**” is derived by the Model through subtracting “**Expected out of stock situations after EPC/RFID**” from “**Out of stock situations due to this cause**” and then the result is multiplied by “**Extrapolated year 5 revenues (100% EPC/RFID)**” times 1 minus the profit margin, which is sourced from the “**Preliminary Information**” worksheet.

Causes of out of stock situations	Out of stock situations due to this cause		Expected out of stock situations after RFID/EPC		Added Revenues	Added Profit	Reduced Costs
Unpredictable environment		0.40%		0.40%	\$0		
High number of unscheduled maintenance events	0.20%		0.20%		\$0		
Unreliable (internal) suppliers	0.20%		0.20%		\$0		
Improper planning		0.80%		0.72%	\$117,128		
Improper scheduling of maintenance	0.08%		0.07%		\$11,713		
Inaccurate Spare parts demand forecasting	0.48%		0.43%		\$70,277		
Improper production planning	0.24%		0.22%		\$35,138		
Inaccuracies in inventory management system		0.60%		0.17%	\$500,722	\$24,597	\$98,388
Theft	0.12%		0.04%			\$24,597	\$98,388
Inaccurate physical counting of inventory	0.42%		0.08%		\$491,938		
Quality issues	0.06%		0.05%		\$8,785		
Product reached the end of its usable life cycle	0.20%	0.20%	0.02%	0.02%		\$52,708	\$210,830
Others	2.00%	2.00%	1.60%	1.60%			\$585,640
Total					\$617,850	\$77,304	\$894,858

Step 4: In the “**Other benefits**” area, the user should input dollar values for “**Current annual value**” and percentage values for “**% of improvement through EPC/RFID**”. The Model will calculate “**Reduced Costs**” by multiplying “**Current annual value**” times “**% of improvement through EPC/RFID**”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs of expediting from central DC	\$200,000	60.00%	\$120,000
Reduce costs of delayed MRO processes	\$1,200,000	30.00%	\$360,000
Reduce costs of purchasing or leasing parts from 3rd parties	\$100,000	60.00%	\$60,000
Reduce costs of penalties by customers	\$300,000	60.00%	\$180,000
Reduce costs of less efficient operations	\$400,000	20.00%	\$80,000
Total	\$2,200,000		\$800,000

5. Business Issue: Traceability

Definition: Airplanes are subject to extreme conditions, that is why strict safety requirements are imposed on MRO organizations. To comply with the regulations, all repairs and modifications are supposed to be properly recorded and documented. This recording and monitoring of parts' history is traceability. By improving parts traceability, MRO organizations are likely to invest less time in maintenance operations, thus reducing operational costs and costs incurred by long down time of aircrafts.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to inefficient traceability (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to inefficient traceability (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to inefficient traceability (as % of revenues)	7.00%	\$10,248,700

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of improper traceability (monitoring parts' history)**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row's values can be from 0% to 100%.

Causes of improper traceability (monitoring parts' history)	Percentage		Max. % reduction through EPC/RFID
Internal/operational causes	%	20.00%	
Improper recording of ingoing outgoing parts	40.00%		30.00%
Improper recording of operations performed	60.00%		30.00%
External causes	%	20.00%	
Lack of consistent standards for registration of parts	50.00%		30.00%
Incompatibility of IT systems	50.00%		30.00%
Improper monitoring capabilities, current ID method	%	20.00%	
Difficulties with current (automatic) Identification solution	70.00%		30.00%
Improper recording of environmental conditions	30.00%		30.00%
Others	%	40.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Improper traceability due to this cause**” (before EPC/RFID by multiplying “**Percentage**” times “**Total costs due inefficient traceability (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row's “**Causes of improper traceability (monitoring parts' history)**”.

“**Expected improper traceability after EPC/RFID**” is calculated by the Model by multiplying “**Percentage**” times 1 minus “**Max % reduction expected through EPC/RFID**”.

“Reduced Costs” is derived by the Model through subtracting “Expected improper traceability after EPC/RFID” from “Improper traceability due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of improper traceability (monitoring parts' history)	Improper traceability due to this cause		Expected improper traceability after EPC/RFID		Reduced Costs
Internal/operational causes		1.40%		0.98%	\$614,922
Improper recording of ingoing outgoing parts	0.56%		0.39%		\$245,969
Improper recording of operations performed	0.84%		0.59%		\$368,953
External causes		1.40%		0.98%	\$614,922
Lack of consistent standards for registration of parts	0.70%		0.49%		\$307,461
Incompatibility of IT systems	0.70%		0.49%		\$307,461
Improper monitoring capabilities, current ID method		1.40%		0.98%	\$614,922
Difficulties with current (automatic) Identification solution	0.98%		0.69%		\$430,445
Improper recording of environmental conditions	0.42%		0.29%		\$184,477
Others	2.80%	2.80%	2.24%	2.24%	\$819,896
Total					\$2,664,662

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. “Added Revenues” and “Reduced Costs” are calculated by the Model by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Added Revenues	Reduced Costs
Reduce costs of rework and scrap	\$300,000	40.00%		\$120,000
Added revenues due to improvement of incorrect identification of part classification	\$400,000	5.00%	\$20,000	
Reduce costs of improper production and planning control	\$300,000	20.00%		\$60,000
Total	\$1,000,000		\$20,000	\$180,000

6. Business Issue: Asset Management

Definition: Especially in the A&D industry, assets, such as tools and MRO equipment, are expensive and also critical to performing specific operations on time. However, due to the size and complexity of a typical MRO operation site, MRO organizations are suffering from loss of tools, equipment, and other assets in their operations site. EPC/RFID implementation may result in better utilization of resources, both tools and labor, and thereby decrease the overall costs of operations.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to inefficient asset management (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to inefficient asset management (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to inefficient asset management (as % of revenues)	7.00%	\$10,248,700

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of inefficient asset management**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of inefficient asset management	Percentage		Max. % reduction through EPC/RFID
Inefficient use of asset tracking procedures	%	20.00%	
Lack of asset tracking procedure		20.00%	0.00%
No fulfillment of asset tracking procedure		80.00%	30.00%
Disorganized processes	%	20.00%	
Unpredictable workload/unscheduled maintenance		50.00%	30.00%
Unstructured work		50.00%	40.00%
Lack of communication	%	10.00%	
Internal communication problems		40.00%	40.00%
External communication problems		60.00%	30.00%
Less visibility in large facilities	%	15.00%	30.00%
Others	%	35.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Inefficient asset management due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to inefficient asset management (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Inefficient asset management due to this cause**”.

“Expected inefficient asset management after EPC/RFID” is calculated by the Model by multiplying “Inefficient asset management due to this cause” times 1 minus “Max % reduction expected through EPC/RFID”.

“Reduced Costs” is derived by the Model through subtracting “Expected inefficient asset management after EPC/RFID” from “Inefficient asset management due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of inefficient asset management	Inefficient asset management due to this cause		Expected inefficient asset management after EPC/RFID		Reduced Costs
Inefficient use of asset tracking procedures		1.40%		1.06%	\$491,938
Lack of asset tracking procedure	0.28%		0.28%		\$0
No fulfillment of asset tracking procedure	1.12%		0.78%		\$491,938
Disorganized processes		1.40%		0.91%	\$717,409
Unpredictable workload/unscheduled maintenance	0.70%		0.49%		\$307,461
Unstructured work	0.70%		0.42%		\$409,948
Lack of communication		0.70%		0.46%	\$348,456
Internal communication problems	0.28%		0.17%		\$163,979
External communication problems	0.42%		0.29%		\$184,477
Less visibility in large facilities	1.05%	1.05%	0.74%	0.74%	\$461,192
Others	2.45%	2.45%	1.96%	1.96%	\$717,409
Total					\$2,736,403

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs due to decrease in throughput time	\$500,000	20.00%	\$100,000
Total	\$500,000		\$100,000

7. Business Issue: Unapproved parts

Definition: Unapproved parts such as rogue parts or salvaged parts are sometimes used and installed in the plane. These parts may cause flight accidents and threaten the flight safety. EPC/RFID technology may help to identify unapproved parts in an early stage. This will overcome usage of unsuitable components for aircraft maintenance, and thereby reduce costs of associated additional required processes. Furthermore, new parts have to be purchased.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs **Total costs due to unapproved parts (as % of revenues)**, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to unapproved parts (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to unapproved parts (as % of revenues)	2.00%	\$2,928,200

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of unapproved parts**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of unapproved parts	Percentage		Max. % reduction through EPC/RFID
Distribution of unapproved parts	%	20.00%	
Distribution of outdated products	20.00%		50.00%
Distribution of rouge parts	40.00%		50.00%
Distribution of salvaged parts	40.00%		50.00%
Human caused errors	%	10.00%	50.00%
Improper monitoring of parts history	%	20.00%	50.00%
Others	%	50.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Unapproved parts due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to unapproved parts (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Causes of unapproved parts**”.

“Expected unproved parts after EPC/RFID” is calculated by the Model by multiplying “Unproved parts due to this cause” times 1 minus “Max % reduction expected through EPC/RFID”.

“Reduced Costs” is derived by the Model through subtracting “Expected unproved parts after EPC/RFID” from “Unproved parts due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of unapproved parts	Unapproved parts due to this cause		Expected unapproved parts after EPC/RFID		Reduced Costs
Distribution of unapproved parts		0.40%		0.20%	\$292,820
Distribution of outdated products	0.08%		0.04%		\$58,564
Distribution of rouge parts	0.16%		0.08%		\$117,128
Distribution of salvaged parts	0.16%		0.08%		\$117,128
Human caused errors	0.20%	0.20%	0.10%	0.10%	\$146,410
Improper monitoring of parts history	0.40%	0.40%	0.20%	0.20%	\$292,820
Others	1.00%	1.00%	0.80%	0.80%	\$292,820
Total					\$1,024,870

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Added Revenues” and “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Added Revenues	Reduced Costs
Added revenues due to improved customer service (lower level of lost sales)	\$300,000	20.00%	\$60,000	
Reduce costs of penalties by customers	\$200,000	30.00%		\$60,000
Total	\$500,000		\$60,000	\$60,000

8. Business Issue: Unscheduled Maintenance

Definition: Unscheduled maintenance is irregular maintenance performed to restore an item to a satisfactory condition by providing correction of a known or suspected malfunction and/or defect. Irregularities occurring during maintenance have been generally known to consist of failures and malfunctions, including findings from scheduled maintenance and inspections, normal flight operations, or special inspections. EPC/RFID technology may lead to reduced costs by reducing the number of unscheduled maintenance events. Since unscheduled maintenance events cause large disruptions within normal operations and therefore lead to lower efficiencies in these operations.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to unscheduled maintenance (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to unscheduled maintenance (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to unscheduled maintenance (as % of revenues)	4.00%	\$5,856,400

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of unscheduled maintenance**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of unscheduled maintenance	Percentage		Max. % reduction through EPC/RFID
Inappropriate parts/Insufficient information about parts	%	20.00%	
Unapproved parts	20.00%		30.00%
Inappropriate monitoring of parts environment	60.00%		50.00%
Function failure (part does not perform after assembly into aircraft system)	20.00%		0.00%
Lack of communication	%	20.00%	
Internal communication problems	40.00%		40.00%
External communication problems	60.00%		30.00%
Inappropriate routine / preventive maintenance	%	10.00%	5.00%
Human caused errors	%	10.00%	50.00%
Others	%	40.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Unscheduled maintenance due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to unscheduled maintenance (as % of revenues)**”. Each sub-row is calculated by the Model and

represents its respective “**Percentage**” of the master row’s “**Unscheduled maintenance due to this cause**”.

“**Expected unscheduled maintenance after EPC/RFID**” is calculated by the Model by multiplying “**Unscheduled maintenance due to this cause**” times 1 minus “**Max % reduction expected through EPC/RFID**”.

“**Reduced Costs**” is derived by the Model through subtracting “**Expected unscheduled maintenance after EPC/RFID**” from “**Unscheduled maintenance due to this cause**” and then the result is multiplied by “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Causes of unscheduled maintenance	Unscheduled maintenance due to this cause		Expected unscheduled maintenance after EPC/RFID		Reduced Costs
Inappropriate parts/insufficient information about parts		0.80%		0.51%	\$421,661
Unapproved parts	0.16%		0.11%		\$70,277
Inappropriate monitoring of parts environment	0.48%		0.24%		\$351,384
Function failure (part does not perform after assembly into aircraft system)	0.16%		0.16%		\$0
Lack of communication		0.80%		0.53%	\$398,235
Internal communication problems	0.32%		0.19%		\$187,405
External communication problems	0.48%		0.34%		\$210,830
Inappropriate routine / preventive maintenance	0.40%	0.40%	0.38%	0.38%	\$29,282
Human caused errors	0.40%	0.40%	0.20%	0.20%	\$292,820
Others	1.60%	1.60%	1.28%	1.28%	\$468,512
Total					\$1,610,510

Step 4: In the “**Other benefits**” area, the user should input dollar values for “**Current annual value**” and percentage values for “**% of improvement through EPC/RFID**”. The Model will calculate “**Reduced Costs**” by multiplying “**Current annual value**” times “**% of improvement through EPC/RFID**”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs of delayed MRO processes	\$1,200,000	30.00%	\$360,000
Reduce costs of higher down time	\$500,000	20.00%	\$100,000
Total	\$1,700,000		\$360,000

9. Business Issue: Rework & Scrap

Definition: Rework & scrap is caused by using inappropriate parts or improper assembly. In providing MRO services or parts, MRO-related companies are facing unnecessary squandering of their resources. EPC/RID technology may lead to a lower amount of rework occasions, which directly results in lower operational costs. Furthermore, reducing the amount of parts scrapped may also result in lower costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to rework/scrap (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to rework/scrap (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to rework/scrap (as % of revenues)	5.00%	\$7,320,500

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of rework/scrap**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of rework/scrap	Percentage		Max. % reduction through EPC/RFID
External causes	%	30.00%	
Lack of communication between airlines and MRO providers	50.00%		20.00%
Unapproved parts	50.00%		30.00%
Internal/operational causes	%	20.00%	
Inappropriate monitoring of parts environment	40.00%		50.00%
Incorrect configuration management	50.00%		50.00%
Inappropriate handling / usage of parts	10.00%		0.00%
Others	%	50.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Rework/scrap due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to rework/scrap (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Rework/scrap due to this cause**”.

“**Expected rework/scrap after EPC/RFID**” is calculated by the Model by multiplying “**Rework/scrap due to this cause**” times 1 minus **Max % reduction expected through EPC/RFID**”.

“Reduced Costs” is derived by the Model through subtracting “Expected rework/scrap after EPC/RFID” from “Rework/scrap due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of rework/scrap	Rework/scrap due to this cause		Expected rework/scrap after EPC/RFID		Reduced Costs
External causes		1.50%		1.13%	\$549,038
Lack of communication between airlines and MRO providers	0.75%		0.60%		\$219,615
Unapproved parts	0.75%		0.53%		\$329,423
Internal/operational causes		1.00%		0.55%	\$658,845
Inappropriate monitoring of parts environment	0.40%		0.20%		\$292,820
Incorrect configuration management	0.50%		0.25%		\$366,025
Inappropriate handling / usage of parts	0.10%		0.10%		\$0
Others	2.50%	2.50%	2.00%	2.00%	\$732,050
Total					\$1,939,933

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Added Revenues” and “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Added Revenues	Reduced Costs
Reduce costs due to decrease in throughput time	\$200,000	20.00%	\$40,000	
Reduce costs of low utilization of assets	\$300,000	20.00%		\$60,000
Reduce costs of low utilization of labor	\$200,000	20.00%		\$40,000
Reduce costs of OOS	\$400,000	30.00%		\$120,000
Total	\$1,100,000		\$40,000	\$220,000

10. Business Issue: Errors Reading/Writing Part Codes Data

Definition: Part codes are defined as part / serial number assigned by a supplier and part / serial number used within own operations. EPC/RFID implementation may decrease the amount of extra work required to correct errors in reading/writing parts' codes, and thereby, directly reduce costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to reading/writing part codes (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to errors in reading/writing part codes (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to errors in reading/writing part codes (as % of revenues)	4.00%	\$5,856,400

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of errors in reading/writing part codes**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of errors in reading/writing part codes	Percentage		Max. % reduction through EPC/RFID
Difficulties with current identification method	%	20.00%	
Used / torn identification plates	50.00%		10.00%
No / difficult line of sight	30.00%		50.00%
Missing identification plates	20.00%		0.00%
Human caused errors in reading / writing	%	20.00%	50.00%
Others	%	60.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Errors in reading/writing part codes due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to OOS situations (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Errors in reading/writing part codes due to this cause**”.

“**Expected errors in reading/writing part codes after EPC/RFID**” is calculated by the Model by multiplying “**Errors in reading/writing part codes due to this cause**” times 1 minus “**Max % reduction expected through EPC/RFID**”.

“Reduced Costs” is derived by the Model through subtracting “Expected errors in reading/writing part codes after EPC/RFID” from “Errors in reading/writing part codes due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)” times.

Causes of errors in reading/writing part codes	Errors in reading/writing due to this cause		Expected errors in reading/writing part codes after EPC/RFID		Reduced Costs
Difficulties with current identification method		0.80%		0.64%	\$234,256
Used / torn identification plates	0.40%		0.36%		\$58,564
No / difficult line of sight	0.24%		0.12%		\$175,692
Missing identification plates	0.16%		0.16%		\$0
Human caused errors in reading / writing	0.80%	0.80%	0.40%	0.40%	\$585,640
Others	2.40%	2.40%	1.92%	1.92%	\$702,768
Total					\$1,522,664

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs of more frequent unscheduled maintenance	\$400,000	10.00%	\$40,000
Reduce costs of erroneous shipment to MRO site or station	\$200,000	30.00%	\$60,000
Reduce costs of inaccurate configuration management	\$300,000	40.00%	\$120,000
Reduce costs of OOS	\$400,000	30.00%	\$120,000
Total	\$1,300,000		\$340,000

11. Business Driver: Trackability

Definition: The knowledge regarding parts' position within the supply chain. EPC/RFID implementation may lead to lower amount of lost parts and associated costs. Furthermore improved trackability may decrease logistics costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to inefficient trackability (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to inefficient trackability (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to inefficient trackability (as % of revenues)	8.00%	\$11,712,800

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of not optimal trackability (monitoring of parts location)**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of not optimal trackability (monitoring of parts location)	Percentage		Max. % reduction through EPC/RFID
Internal/operational causes	%	30.00%	
Discrepancies in asset inventory management system	80.00%		30.00%
Improper registration of incoming and outgoing parts	20.00%		30.00%
External causes	%	20.00%	
Lack of consistent standards for registration of parts	25.00%		30.00%
Incompatibility of IT systems	60.00%		30.00%
Lack of communication between parties	15.00%		30.00%
Others	%	50.00%	15.00%
Total		100%	

Step 3: The Model will derive “**Not optimal trackability due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to not optimal trackability (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Not optimal trackability due to this cause**”.

“Expected not optimal trackability after EPC/RFID” is calculated by the Model by multiplying “Not optimal trackability due to this cause” times 1 minus **Max % reduction expected through EPC/RFID**”.

“Reduced Costs” is derived by the Model through subtracting “Expected not optimal trackability after EPC/RFID” from “Not optimal trackability due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of not optimal trackability (monitoring of parts location)	Not optimal trackability due to this cause		Expected not optimal trackability after EPC/RFID		Reduced Costs
Internal/operational causes		2.40%		1.68%	\$1,054,152
Discrepancies in asset inventory management system	1.92%		1.34%		\$843,322
Improper registration of incoming and outgoing parts	0.48%		0.34%		\$210,830
External causes		1.60%		1.12%	\$702,768
Lack of consistent standards for registration of parts	0.40%		0.28%		\$175,692
Incompatibility of IT systems	0.96%		0.67%		\$421,661
Lack of communication between parties	0.24%		0.17%		\$105,415
Others	4.00%	4.00%	3.40%	3.40%	\$878,460
Total					\$2,635,380

Step 4: In the “**Other benefits**” area, the user should input dollar values for “**Current annual value**” and percentage values for “**% of improvement through EPC/RFID**”. The Model will calculate “**Added Revenues**” and “**Reduced Costs**” by multiplying “**Current annual value**” times “**% of improvement through EPC/RFID**”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Added Revenues	Reduced Costs
Reduce costs of low utilization of assets	\$600,000	50.00%		\$300,000
Added revenues due to improved customer service level	\$800,000	15.00%	\$120,000	
Total	\$1,400,000		\$120,000	\$300,000

12. Business Driver: Returnable Assets

Definition: Returnable asset management (through the supply chain tracking and locating of returnable assets - containers, totes, bins, etc.). EPC/RFID implementation may result in lower amount of lost returnable assets (e.g. theft) and thereby directly decrease the costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to improper returnable assets management (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to improper returnable assets management (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to improper returnable assets management (as % of revenues)	5.00%	\$7,320,500

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of not optimal returnable asset management**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of not optimal returnable asset management	Percentage		Max. % reduction through EPC/RFID
Internal/operational causes	%	20.00%	
Discrepancies in asset inventory management system	30.00%		50.00%
Improper registration of incoming and outgoing assets	70.00%		50.00%
External causes - Lack of communication between parties		10.00%	30.00%
Others	%	70.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Not optimal returnable asset management due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to not optimal returnable asset management (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row’s “**Not optimal returnable asset management due to this cause**”.

“**Expected not optimal returnable asset management after EPC/RFID**” is calculated by the Model by multiplying “**Not optimal returnable asset management due to this cause**” times 1 minus “**Max % reduction expected through EPC/RFID**”.

“**Reduced Costs**” is derived by the Model through subtracting “**Expected not optimal returnable asset management after EPC/RFID**” from “**Not optimal returnable asset**”.

management due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of not optimal returnable asset management	Not optimal returnable asset management due to this cause		Expected not optimal returnable asset management after EPC/RFID		Reduced Costs
Internal/operational causes		1.00%		0.50%	\$732,050
Discrepancies in asset inventory management system	0.30%		0.15%		\$219,615
Improper registration of incoming and outgoing assets	0.70%		0.35%		\$512,435
External causes - Lack of communication between parties	0.50%	0.50%	0.35%	0.35%	\$219,615
Others	3.50%	3.50%	2.80%	2.80%	\$1,024,870
Total					\$1,976,535

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs of low utilization of assets	\$900,000	20.00%	\$180,000
Total	\$900,000		\$180,000

13. Business Driver: Manual Administrative Processes

Definition: In the aerospace industry often transformation (production, assembly and MRO) or transportation (inbound and outbound) of parts requires manual administrative processes. These processes are needed to (uniquely) identify the part and its current position and to register additional information of the parts, such as maintenance history, repair procedure performed and information about the production batch it belonged to. EPC/RFID implementation may lead to more efficient use of machine and labor resources and thereby reduce costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to manual administrative processes (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to manual administrative processes (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to manual administrative processes (as % of revenues)	6.00%	\$8,784,600

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of extensive manual administrative processes**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row’s values can be from 0% to 100%.

Causes of extensive manual administrative processes	Percentage		Max. % reduction through EPC/RFID
Inability of current ID method to automate data gathering	%	20.00%	
Human readable plate	50.00%		50.00%
1D Bar code	30.00%		50.00%
2D Bar code	15.00%		50.00%
Memory buttons	5.00%		50.00%
Others	%	80.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Extensive manual administrative processes due to this cause**” (before EPC/RFID (as % of yr 5 revenues) by multiplying “**Percentage**” times “**Total costs due to extensive manual administrative processes (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective

“Percentage” of the master row’s “Extensive manual administrative processes due to this cause”.

“Expected extensive manual administrative processes after EPC/RFID” is calculated by the Model by multiplying “Extensive manual administrative processes due to this cause” times 1 minus “Max % reduction expected through EPC/RFID”.

“Reduced Costs” is derived by the Model through subtracting “Expected extensive manual administrative processes after EPC/RFID” from “Extensive manual administrative processes due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of extensive manual administrative processes	Extensive manual administrative processes due to this cause		Expected extensive manual administrative processes after EPC/RFID		Reduced Costs
Inability of current ID method to automate data gathering		1.20%		0.60%	\$878,460
Human readable plate	0.60%		0.30%		\$439,230
1D Bar code	0.36%		0.18%		\$263,538
2D Bar code	0.18%		0.09%		\$131,769
Memory buttons	0.06%		0.03%		\$43,923
Others	4.80%	4.80%	3.84%	3.84%	\$1,405,536
Total					\$2,283,996

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Added Revenues” and “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Added Revenues	Reduced Costs
Reduce costs of down time of an aircraft due to decreased throughput time of MRO processes	\$700,000	30.00%		\$210,000
Added revenues due to higher customer service (shorter lead times)	\$200,000	30.00%	\$60,000	
Total	\$900,000		\$60,000	\$0

14. Business Driver: Inbound - Outbound

Definition: Inbound processes are those activities performed when receiving goods at the entrance of a facility (e.g. factory, distribution centre, maintenance shop). These activities might consist of; reading pallet, box and/or parts' codes, de-stacking and unpacking if necessary, checking quality of incoming goods, checking parts' documentation and entering the incoming goods, with if necessary additional information, into the information system. EPC/RFID technology might prevent errors in inbound/outbound operations and/or make them more efficient. This will ultimately lead to lower costs.

Step 1: “**Current annual revenue**” is sourced from the “**Preliminary Information**” worksheet. The Model takes “**Current annual revenue**” from the “**Preliminary Information**” worksheet and calculates “**Extrapolated year 5 revenues (100% EPC/RFID)**” by using the “**Expected annual business growth rate**”.

The user inputs “**Total costs due to inefficient inbound-outbound processes (as % of revenues)**”, which is used by the Model to calculate the dollar amount. The Model multiplies the percentage value of “**Total costs due to inefficient inbound-outbound processes (as % of revenues)**” times “**Extrapolated year 5 revenues (100% EPC/RFID)**”.

Company		
Current annual revenue		\$100,000,000
Extrapolated year 5 revenues (100% EPC/RFID)		\$146,410,000
Total costs due to inefficient inbound-outbound processes (as % of revenues)	6.00%	\$8,784,600

Step 2: The user inputs percentage values in all *gray* “**Percentage**” cells. Note: Where cells are marked in *white*, the Model will calculate the balance of each of the areas in “**Causes of not optimal inbound/outbound processes**”. For percentage values located in “**Max. % reduction through EPC/RFID**”, the user should input the expected maximum percentage that can be reduced by implementing EPC/RFID. Each of the row's values can be from 0% to 100%.

Causes of not optimal inbound/outbound processes	Percentage		Max. % reduction through EPC/RFID
Improper monitoring of parts location (trackability)	%	30.00%	50.00%
Unstructured work	%	5.00%	30.00%
Difficulties with current identification method	%	20.00%	
Difficulties with current automatic ID solution	30.00%		50.00%
Human caused errors	70.00%		50.00%
Others	%	45.00%	20.00%
Total		100%	

Step 3: The Model will derive “**Not optimal inbound/outbound processes due to this cause**” (before EPC/RFID) by multiplying “**Percentage**” times “**Total costs due to not optimal inbound/outbound processes (as % of revenues)**”. Each sub-row is calculated by the Model and represents its respective “**Percentage**” of the master row's “**Not optimal inbound/outbound processes due to this cause**”.

“Expected not optimal inbound/outbound processes after EPC/RFID” is calculated by the Model by multiplying “Not optimal inbound/outbound processes due to this cause” times 1 minus Max % reduction expected through EPC/RFID”.

“Reduced Costs” is derived by the Model through subtracting “Expected not optimal inbound/outbound processes after EPC/RFID” from “Not optimal inbound/outbound processes due to this cause” and then the result is multiplied by “Extrapolated year 5 revenues (100% EPC/RFID)”.

Causes of not optimal inbound/outbound processes	Not optimal inbound/outbound processes due to this cause		Expected not optimal inbound/outbound processes after EPC/RFID		Reduced Costs
Improper monitoring of parts location (trackability)	1.80%	1.80%	0.90%	0.90%	\$1,317,690
Unstructured work	0.30%	0.30%	0.21%	0.21%	\$131,769
Difficulties with current identification method		1.20%		0.60%	\$878,460
Difficulties with current automatic ID solution	0.36%		0.18%		\$263,538
Human caused errors	0.84%		0.42%		\$614,922
Others	2.70%	2.70%	2.16%	2.16%	\$790,614
Total					\$1,800,843

Step 4: In the “Other benefits” area, the user should input dollar values for “Current annual value” and percentage values for “% of improvement through EPC/RFID”. The Model will calculate “Reduced Costs” by multiplying “Current annual value” times “% of improvement through EPC/RFID”.

Other benefits	Current annual value	% of improvement through EPC/RFID	Reduced Costs
Reduce costs of delayed MRO processes	\$1,200,000	30.00%	\$360,000
Reduce costs of discrepancies in inventory management system	\$400,000	40.00%	\$160,000
Total	\$1,600,000		\$520,000