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Reducing Maintenance Costs Using Beyond Economic Repair Analysis

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Beyond Economic Repair - Introduction

- Definition
  - Beyond Economic Repair (BER) analysis compares the cost of repairing a part or assembly with the cost of replacing it.
  - The purpose is to determine the least expensive method of returning a product to service.
  - A BER analysis can start out as a prediction then use actual repair data as it becomes available

- The Benefits
  - Reduced Maintenance Costs
    - Products that are not economically repairable will be replaced (lower cost)
  - Improved Warranty Performance
    - Reduced maintenance costs – company benefit
    - Reduced turn around time – customer benefit

A BER Analysis Can Reduce Costs & Provide Better Service

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BER Data and Cost Elements

- Data and Cost Elements Used in a BER Include:
  - Repairable Parts or Assemblies
    - Reparability may not be known until repairs are attempted
  - Unit Cost of Repairable Parts or Assemblies
  - Labor Rates
    - Touch (repair technician)
    - Engineering Support – includes all administrative or clerical services
  - Average Materiel Cost of Repair
    - Historically 20% of a parts unit cost is added to repair cost for materiel
    - The 20% figure can be adjusted for specific parts or assemblies
  - BER Threshold cost
    - Many models use a repair cost of 70% of unit cost as the threshold
    - Repair costs below 70% of the unit cost are considered economical
      - A new RA will have a longer expected life than a repaired one

Accurate Cost Accounting Means an Accurate BER

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BER Data and Cost Elements

- Economic Repair Yield
  - Economical Repair Yield % must be greater than BER threshold % for repair to be economical (discussed in detail on slides 11 and 12)

Accurate Cost Accounting Means an Accurate BER

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The Model

	A	B	C	D	E	F	G	H	I	J	K
1	BEYOND ECONOMIC REPAIR (BER) REPLACEABLE ASSEMBLY (RA) MATRIX										
2	Top Assy Serial Number										Economic
3	Replaceable Assembly (RA)	Part number	Unit Cost	Max Repair Labor Hrs	Recorded Labor Hrs	Remaining Labor Hrs	Repair Labor Cost	Repair Material	Material and Labor Cost	BER threshold	Repair Yield
4	Cover	XXXXXXX-X	$165	0.33		0.33	$0	$33	$33	$116	70%
5	Harness, Wiring	XXXXXXX-X	$1,550	3.10		3.10	$0	$310	$310	$1,085	65%
6	Cable	XXXXXXX-X	$3,360	9.27		9.27	$0	$34	$34	$2,352	65%
7	Cryoengine	XXXXXXX-X	$11,050	22.10		22.10	$0	$2,210	$2,210	$7,735	50%
8	Heatsink	XXXXXXX-X	$190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Circuit Card Assy 1	XXXXXXX-X	$2,020	4.04		4.04	$0	$404	$404	$1,414	50%
10	Circuit Card Assy 2	XXXXXXX-X	$2,710	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	IMU	XXXXXXX-X	$14,150	28.30		28.30	$0	$2,830	$2,830	$9,905	95%
12	Bulkhead	XXXXXXX-X	$85	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13	DC\DC Conv	XXXXXXX-X	$3,690	7.38		7.38	$0	$738	$738	$2,583	TBD
14	Filter	XXXXXXX-X	$1,590	3.18		3.18	$0	$318	$318	$1,113	TBD
15											
16	Hourly Touch Labor Cost:	$70.00									
17	Hourly Support Labor Cost:	$120.00									
18	Total Repair labor "hour"	$250.00									
19											
20	Data input cell										
21	Always replace										

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Developing The Model

- Identify The Replaceable Assemblies RAs) (Columns A, B)
  - Identify the lowest level part(s) that can be repaired or replaced
    - Example: Circuit Card
  - A product that been in service for some time may already have parts that have failed – Check with Service Manager or Repair Facility
- Determine Unit Cost for RAs (Column C)
  - Establish a cost for purchasing an RA (internal or external supplier)
  - Quantity purchases based on predicted failures may reduce the Unit Cost

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Developing The Model

- Determine Touch and Support Labor Rates (Cells B16, B17)
  - Check with Finance or Repair Facility
  - Determine amount of Support Labor to charge for each hour of Touch Labor
    - For an existing product the Repair Facility or Finance Department may have data.
    - For a new product a ratio of 1.5 Support to 1 Touch can be used until actual figures are available.
  - Add Cells B16 and B17 to determine the cost of a repair labor “hour”
    - Equation in Cell B18 is: =B16+1.5*B17
- Determine Repair Material Cost (Column H)
  - 20% of unit cost is standard
  - The equation in Cell H4 is: =.2*C4
    - And so on for the rest of Column H
    - Cell H6 Repair Material is 1% of unit cost due to repetitive failure (directed by Service Manager)

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Developing The Model

- Calculate BER Threshold for the RAs (Column J)
  - 70% of Unit Cost threshold equation in cell J4: =.7*C4
    - And so on for the rest of Column J
- Calculate Max Repair Labor Hours (Column D)
  - Subtract Repair Material cost from the threshold which leaves labor cost
  - Divide labor cost by a Total Repair labor “hour” to get the maximum hours that can be spent on an economical repair
  - Equation in Cell D4: =(J4-H4)/B18
    - And so on for the rest of Column D
  - Repair Labor Hrs are for repair of the RA only, they do not include re-installation into the Next Higher Assembly (NHA) or product, whichever is applicable
    - Hours for re-installation of the RA are charged at the applicable level

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Developing The Model

- Remaining Labor Hrs
  - Repair Technician records repair hours for an RA in column E
  - Provides information for the repair technician about how much times remains for a economical repair
  - Equation in Cell F4 is: =D4-E4
    - And so on for the rest of Column F
    - The cells in column F can be formatted so that if the repair time exceeds the Max Repair Labor Hrs the number is red
- Repair Labor Cost
  - Shows how much money has been spent on labor
  - Equation in Cell G4 is: =E4*B18
    - And so on for the rest of Column G

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Developing The Model

- Material and Labor Cost
  - Shows how much money has been spent on repair
  - Equation in Cell I4 is: =G4+H4
    - And so on for the rest of Column I
    - The cells in column I can be formatted so that if the cost exceeds the BER threshold in Column J the number is red

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Determining Economic Repair Yield

- Economic Repair Yield is Another Factor to Determine Repair or Discard
  - Repair Time and Yield data must be available
  - Divide the number of successful repairs that required less than the Max Repair Labor Hrs by the number of attempted repairs to get a repair yield in percent
  - Do not use an average repair time for all successful repairs to determine a repair yield percentage
    - A few high or low numbers can skew the average
    - Record the percentage in column K

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Repair Cost as a Function of Repair Yield

- Assumption
  - Max Repair Labor Hrs are used
    - Not all repairs require the Maximum hours - the analysis is conservative
    - A Service Manager may choose to attempt repairs at lower economical repair yields depending on repair history for a particular RA

	A	B	C	D	E	F
1	Replaceable Assembly (RA)	Part number	Unit Cost	BER threshold	Economical Repair Yield	Repair\Replace Cost per unit (100 units)
2	Harness, Wiring	XXXXXXX-X	$1,550	$1,085	68%	$1,581
3	Harness, Wiring	XXXXXXX-X	$1,550	$1,085	69%	$1,566
4	Harness, Wiring	XXXXXXX-X	$1,550	$1,085	70%	$1,550
5	Harness, Wiring	XXXXXXX-X	$1,550	$1,085	71%	$1,535
6	Harness, Wiring	XXXXXXX-X	$1,550	$1,085	72%	$1,519

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Using The Model

- Enter RAs and Part Numbers – Columns A and B
- Enter Unit Costs – Column C
  - Repair Material costs (column H) and BER threshold costs (Column J) will be calculated when Unit Costs are entered
- Enter Hourly Touch Labor Cost in cell B16 and Support Labor Cost in cell B17
  - The Total Repair Labor "hour" will be calculated in cell B18 and the Max Repair Labor Hrs will be calculated in Column D
- If Economic Repair Yields have been calculated enter them in Column K

Populate the Model with Basic Data

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Using The Model

- The BER spreadsheet may show that some RAs will not be economically repairable either because their Unit Cost is so low that even the minimum time necessary to repair them exceeds their Unit Cost or their repair yield is so low that attempting repair is not economical
- Before a repair technician begins repair work on a particular RA he (she) looks at the Max Repair Labor Hrs (column D) allowed for an economical repair
- As a repair proceeds the technician can enter the amount of time spent repairing the RA in column E, the remaining time allowed for an economical repair is calculated in Column F

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Using The Model

- The repair technician may decide, after consulting with manufacturing engineering, to end repair work at any point because additional repair work not result in a successful repair – a new RA would be re-installed in the NHA
- If the amount of time spent repairing an RA exceeds the Max Repair Labor Hrs in column D the Remaining Labor Hrs in Column F and the Material and Repair cost in column I will turn red meaning the repair work has exceeded the economical threshold
  - This is an indication that repair work on the RA should be stopped and a new RA used for the NHA

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Review, Implementation and Revision

- Review
  - Conduct a peer review and quality check
- Implementation
  - Have Service Manager and Program Manager Review the Tool
    - The Service Manager or Program manager may modify the recommendations of the model due to supply chain and other issues
      - some RAs that are not economically repairable may no longer be in production
    - Buy In of the Service Manager is critical for successful use of the BER Tool
- Revision
  - Establish a revision cycle to update changing data
    - Repair and Support Labor rates
    - Unit costs and Repair Yields

Keep BER Tool Data Up To Date After Implementation

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Conclusion

- A BER analysis is a recommendation to help determine the most cost effective way of maintaining a product
- Other factors that affect the decision:
  - Reparability
  - Availability of Parts
  - Repair facility factors

BER Analysis is the economic factor of Product Support