Are You Repair Focused Or Reliability Focused? How To Change?

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So, when do you forecast your next failure will occur?—Accept it?—Prevent it?

The Focus Implies--

- **Repair focus** implies allowance of failures
- **Reliability focus** implies avoidance of failures
- Three areas offer contrasts to the changes in attitudes and interest during the past 40 years
- Let's see the changes to understand what has happened and why the change

Compare Safety Programs

- Years ago we knew "accidents happen" and rapid first aid efforts were accepted (repair focus)
- Today we have safety policies that say: **We will have an <u>accident free</u> facility.** Today's safety programs do not accept accidents (reliability focus)

  Considered Impossible 40 Years Ago

- The results:
  Lower costs. Few injuries.

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Compare Quality Programs

- Years ago we knew "quality perfection is impossible" and rapid rework efforts were accepted (repair focus)
- Today we have quality policies that say: **We will ship <u>defect free</u> products.** Today's quality programs do not accept scrap/rework (reliability focus)

  Considered Impossible 20 Years Ago

- The results:
  Lower costs. Few recalls.

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Compare Environmental Programs

- Years ago we knew "environmental exceedance would occur" and clean up efforts were accepted (repair focus)
- Today our environmental policies say: **We will have <u>no environmental spills or releases</u>.** Today's environmental programs do not allow flares, spills, or odors (reliability focus)

  Considered Impossible 2 Years Ago

- The results: Lower costs. Few problems

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The Challenge: What Does Your Reliability Policy Say?

- Years ago we knew "equipment failures will occur" and fast repair efforts were the norm (repair focus)
- Today our reliability policies say : **We will build an economical and failure free process which will <u>operate without failure</u> for 5 years between planned turnarounds.** Today's reliability programs do not allow process failures (reliability focus)

  Considered Impossible Today?

- The results: Lower costs. Higher returns. Fewer problems.

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Are You Repair Focused?

- Fast repairs are super important.
- We reward our personnel on quick repairs with hero awards for extra ordinary repair team efforts.
- We believe we can repair ourselves to happiness.

MIL-HDBK-338: **Repair Time**- The time spent replacing, repairing, or adjusting all items suspected to have been the cause of the malfunction, except those subsequently shown by interim test of the system not to have been the cause.

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Are You Reliability Focused?

- A reliability focus is concerned with **avoiding failures** of equipment and **processes** by proper design and careful operation of the equipment by trained personnel in a specified environment for a given time interval.
- The ultimate aim of a reliability focus is a **failure free environment**.

MIL-HDBK-338: **Reliability**- 1) The duration or probability of failure-free performance under stated conditions. 2) The probability that an item can perform its intended function for a specified interval under stated conditions.

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Most Organizations say…

- ~2 out of 3 say "I'm reliability-focused" **but they demonstrate a repair-focus.** They reward fast repairs. No rewards occur for failure avoidance.
- Only ~1 out of 3 demonstrate a reliability-focus
- If you wanted an objective view of how your organization is doing, how would you show the results?

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How To Prove The Claim Of Reliability or Repair Focus?

- Stable processes of cum failures versus cum time give straight lines on log-log plots as explained in MIL-HDBK-189 by Dr. Larry Crow
- Line slopes (beta) on reliability growth plots (today called Crow-AMSAA plots) tell you are:
  **beta <1 → reliability-focus slower failures
  beta >1 → repair-focus increasing failures**
- What do your facts show:
  **1) reliability-focus?
  2) repair focus?**
- **Show me, don't tell me, how you're doing!**

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Failures are?

- Failures terminate reliability.
- Is your organization:
    1) **Reliability-focused** (**abhor failures**)?
  or
    2) **Repair-focused** (**accept repairs**)?
- How do you prove your focus based on failure data from your plant?

MIL-HDBK-338: Failure- The event, or inoperable state, in which any item or part of an item does not, or would not, perform as previously specified.
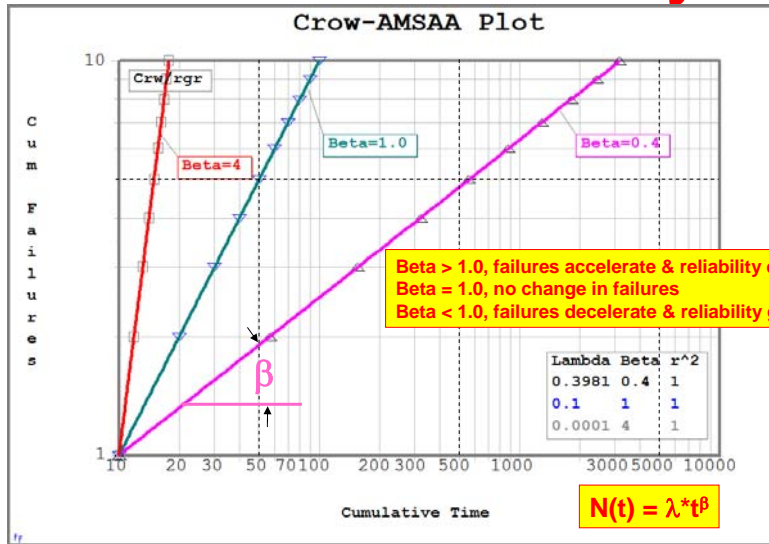
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Treat Repairs As Failures

- **Management views repairs as failures!** Why? Repairs cost money. Repairs take equipment out of service
- Too many repairs occur from accelerated consumption of life due to errors from both omission and commission
- **You cannot repair yourself to happiness —avoiding failures brings happiness**

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A Crow-AMSAA Plot Says…?

Crow-AMSAA Plot

Crw/rgr

Beta=4

Beta=1.0

Beta=0.4

Cum Failures

β

Beta > 1.0, failures accelerate & reliability declines
Beta = 1.0, no change in failures
Beta < 1.0, failures decelerate & reliability grows

Lambda	Beta	r^2
0.3981	0.4	1
0.1	1	1
0.0001	4	1

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10 20 30 50 70 100 200 300 500 1000 3000 5000 10000

Cumulative Time

N(t) = λ*t^β

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How To Collect Your Data

- Go to SAP. Get monthly work orders for (emergence repairs + ordinary repairs). This is monthly/weekly/daily interval data.
- Convert interval data into cumulative time (for the X-axis) and cumulative repairs (for the Y-axis).
- Plot cum data on log-log paper. Trend line slope, β, gives clues as to what you are.

Failures: For managers, every maintenance order is a failure because of money spent!

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5-1/2 Years Of Corporate Data

Raw Data Date	Orders	Cum Days	Cum Orders
Jan 2001	444	31	444
Feb 2001	517	59	961
Mar 2001	749	90	1710
Apr 2001	786	120	2496
. . . .	. . . . . .	. . . . .	. . . .
Jun 2006	1490	2007	106,475
Jul 2006	1408	2038	107,883
Aug 2006	1503	2069	109,386

Plot this data on a log-log plot. The line slope is very important.

- Plant sites have been stable during interval —no big expansions, acquisitions, or closures
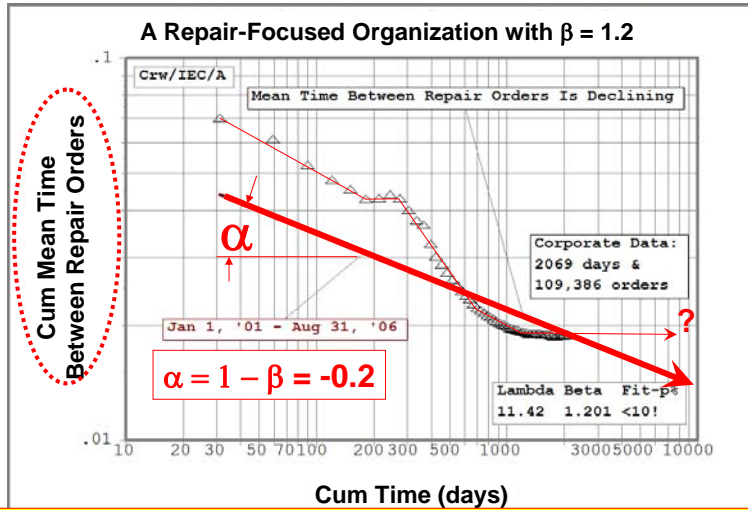
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Corporate View Of Repairs

A Repair Focused Organization

Crw/IEC/A

Forecast of coming repairs!

Jan 1, '01 – Aug 31, '06

$\beta = 1.2$

Corporate Data:
2069 days &
109,386 orders

Lambda Beta Fit-p%
11.42 1.201 <10!

Cumulative Time (days)
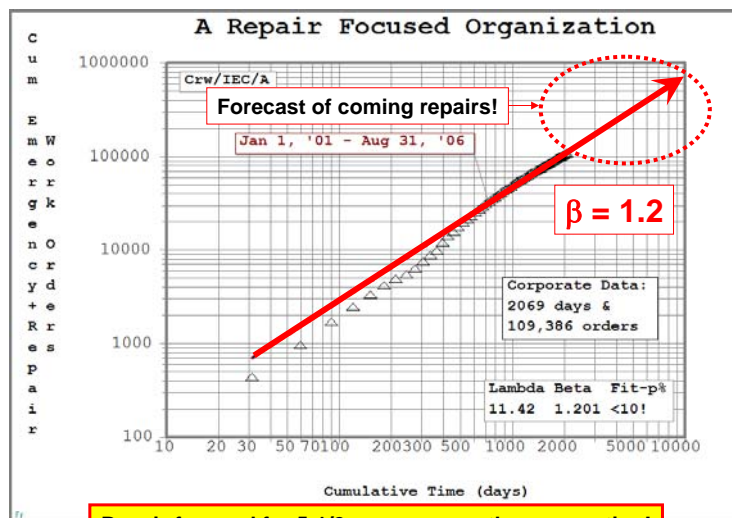
Repair-focused for 5-1/2 years across the corporation!

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Corporate View Of Repairs

A Repair-Focused Organization with β = 1.2

Mean time between repair orders has recently stabilized at ~53 orders/day

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72-inch Cooling Water Line

72-inch Water Line: Repair-Focus to Reliability-Focus
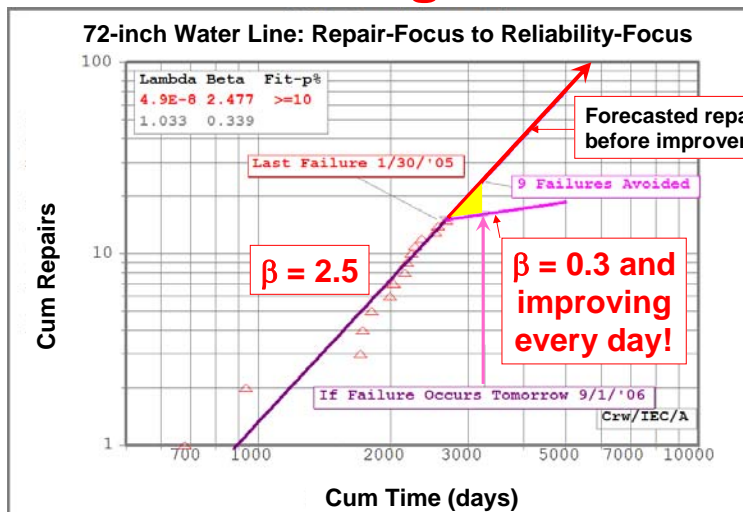
Repair-focused with β=2.5 changed to reliability-focused with β=0.34

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Chemical Plant Safety Data

First Aid + Reportable Accidents + Lost Time Accidents
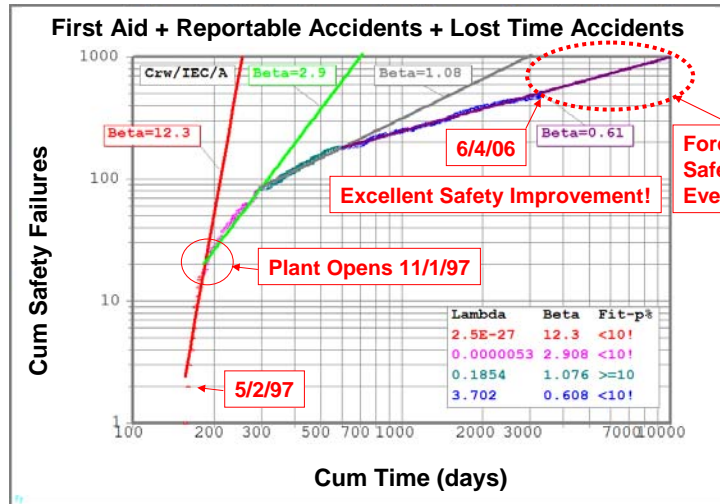
Injury accepting with β=12.3 **changed** to **injury prevention** with β=0.61

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Cum MTBF-Safety Data

First Aid + Reportable Accidents + Lost Time Accidents
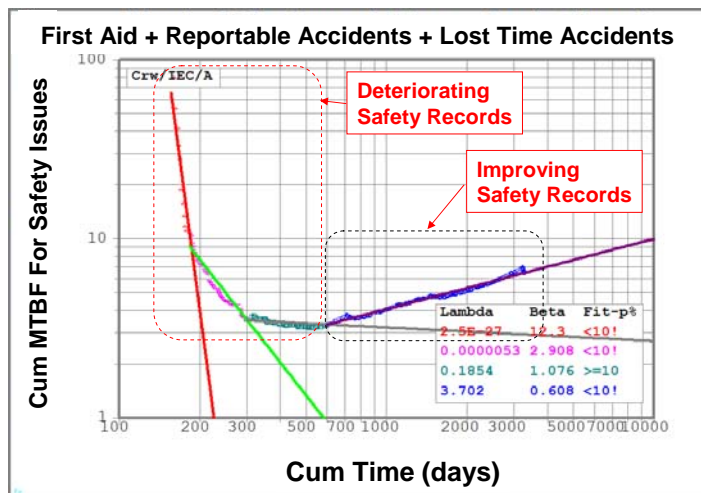
Mean time between safety event is growing from a reliability-focus

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Which Is More Important?

- **Avoiding failures OR repairing failures?**
  - **You cannot repair yourself to happiness!**
- **Equipment OR processes/people?**
  - Equipment = not as effective as working on Processes/Procedures/People = greater gains
- **Trained operators OR maintainers?**
  - Untrained operators and poor processes/ procedures can break equipment faster than trained maintainers can make repairs

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Maintenance Is?

- Maintenance is concerned with retaining function or quickly correcting failures, by use of <u>trained employees</u> using <u>correct procedures</u>.
- The ultimate aim of maintenance is minimizing maintenance costs and downtime to keep equipment operating as designed.

MIL-HDBK-338: **Maintenance**-All actions necessary for retaining an item in or restoring it to a specified condition.

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Engineers Are---?

- Reliability Engineers-<u>Strategic</u> Assets
  - Dedicated to mainly preventing failures
- Maintenance Engineers-<u>Tactical</u> Assets
  - Dedicated to mainly correcting failures
- You need ~10 Maintenance Engineers to every 1 Reliability Engineer
  - No increase in plant head count

Need job descriptions?: http://www.barringer1.com/jobdescriptions.htm

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Business Is?

- Business is all about making money. This is a balance between avoiding failures, repairing failures, and keeping the process operating to make money.
- In the end, reliability and maintenance are all about money.
- The ultimate aim of business is satisfying customers with on-time deliveries of quality products while producing a satisfactory long-term return for stockholders.

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Get Organized

- Most mangers talk about reliability <u>but emphasize maintenance</u>---they cross communicate!!
  - **Get your organization right**
  - **Get your emphasis right—say the right things**
  - **Get your motivation right—what's the reward?**
  - **Be consistent—no wishy-washy positions!**
  - **Work for long terms improvements**
  - **Work your Pareto list based on $'s—not nose counts of problems!!!**
  - **Show your progress with Crow-AMSAA plots**

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Where To Improve?

- Go for the **money (actual + risk)**—not love affairs!
  - Does the **system** need improvement?
  - Does a **device/component** need improvement?
  - Does a **process/procedure** need improvement?
  - Do the **people** need improvement?
- What are your alternative**s**?—say it with money
- Correct the big **$** problems by considering alternatives. Show how you're doing with Crow-AMSSA plots.

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Best Place For Gains?

- Improve **people performance**—~38% of problems
  - Make it easy for people to do right & hard to do wrong
- Improve **procedures and practices**—~34%
  - Write it down correctly and train, train, train
- Improve **hardware**—~28% of problems
  - Hardware problems may disappear if above corrected
- Engineers, by nature, think reliability issues are resolved with hardware and components. Thus they often work on the wrong issues!

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Summary

- Get your reliability program right
- Think about reliability issues strategically
- Look for gains <u>first</u> via people, <u>second</u> by processes and procedures, and <u>last</u> by way of components—many component issues disappear when people/processes/procedure issues are solved to achieve inherent component reliability!
- Show your organization how you're doing with Crow-AMSAA plots: **Show me, don't tell me!**

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