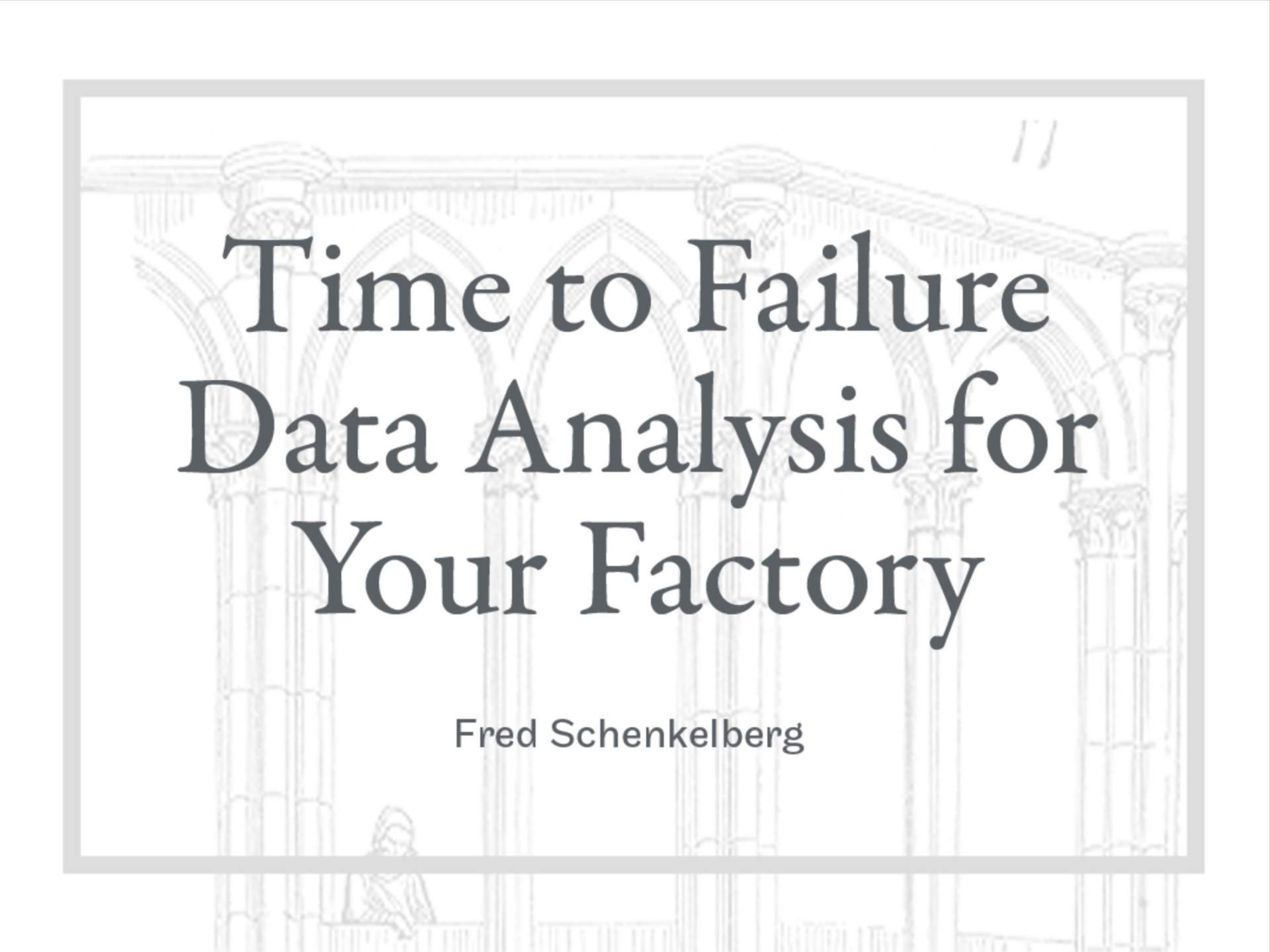




Time to Failure Data Analysis for Your Factory

Fred Schenkelberg



Adjust Strategy

A photograph of a busy city street at night. Several cars are visible, including a dark blue car in the foreground on the left with its headlights on, and a silver car on the right. The street is filled with traffic, and the background shows city lights and buildings. The word "Prioritize" is overlaid in white text in the center of the image.

Prioritize



Detect
Problems

Do you have
repair data?

What do you do with data?



Table of Numbers



Simple MTBF Calculation



Trend plotting

Let's look at some data



We need perfect data, and rarely will find it.

Let's pull the last quarter of repair events for three machines.

What is the form of the data?

Machine 1

112	615
198	692
301	820
425	907
509	989

Machine 2

112	760
293	813
480	849
560	898
702	920

Machine 3

112	350
142	424
191	563
230	710
280	879

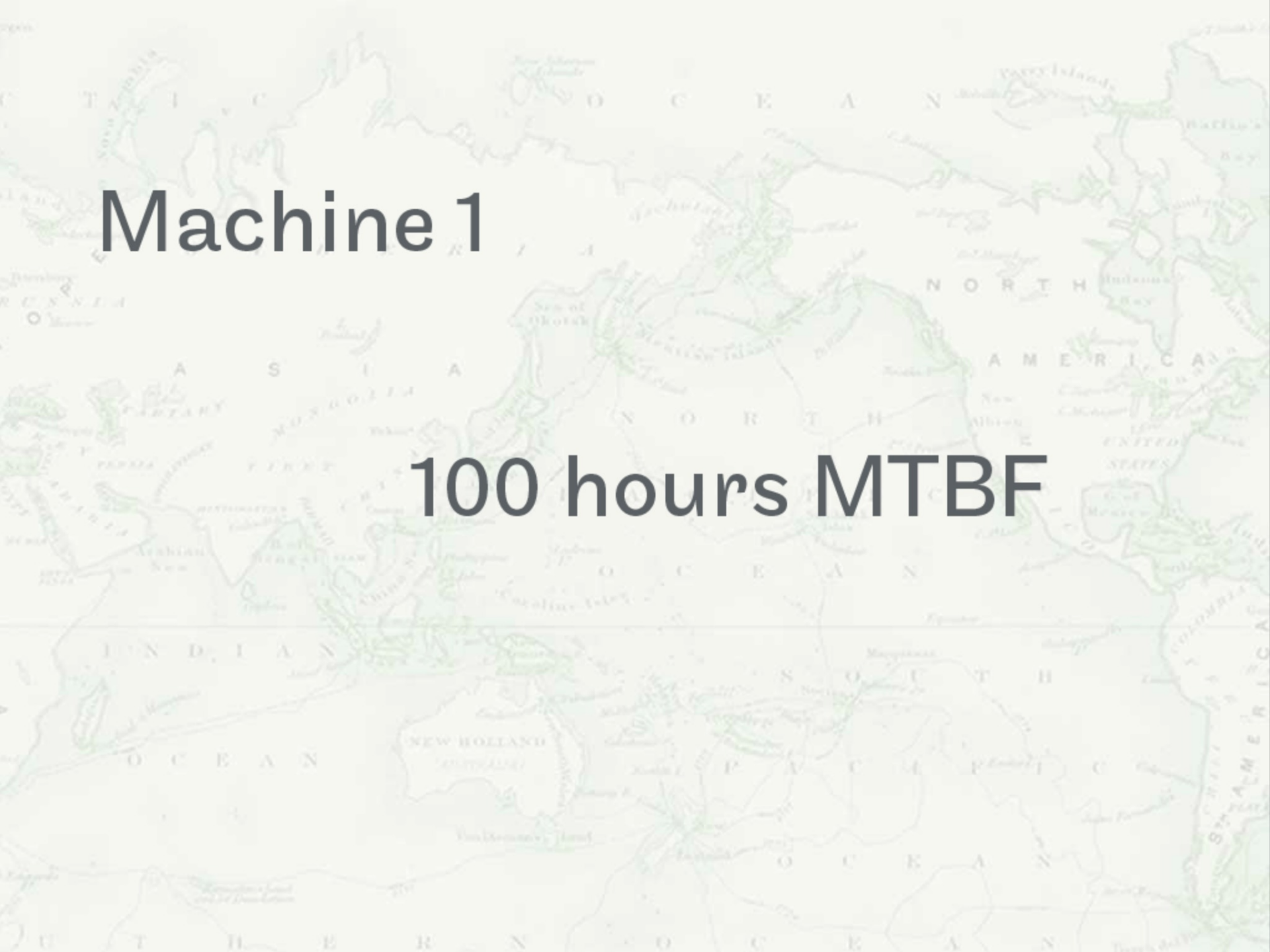
MTBF is for repairable systems



Please do not say you use
MTBF

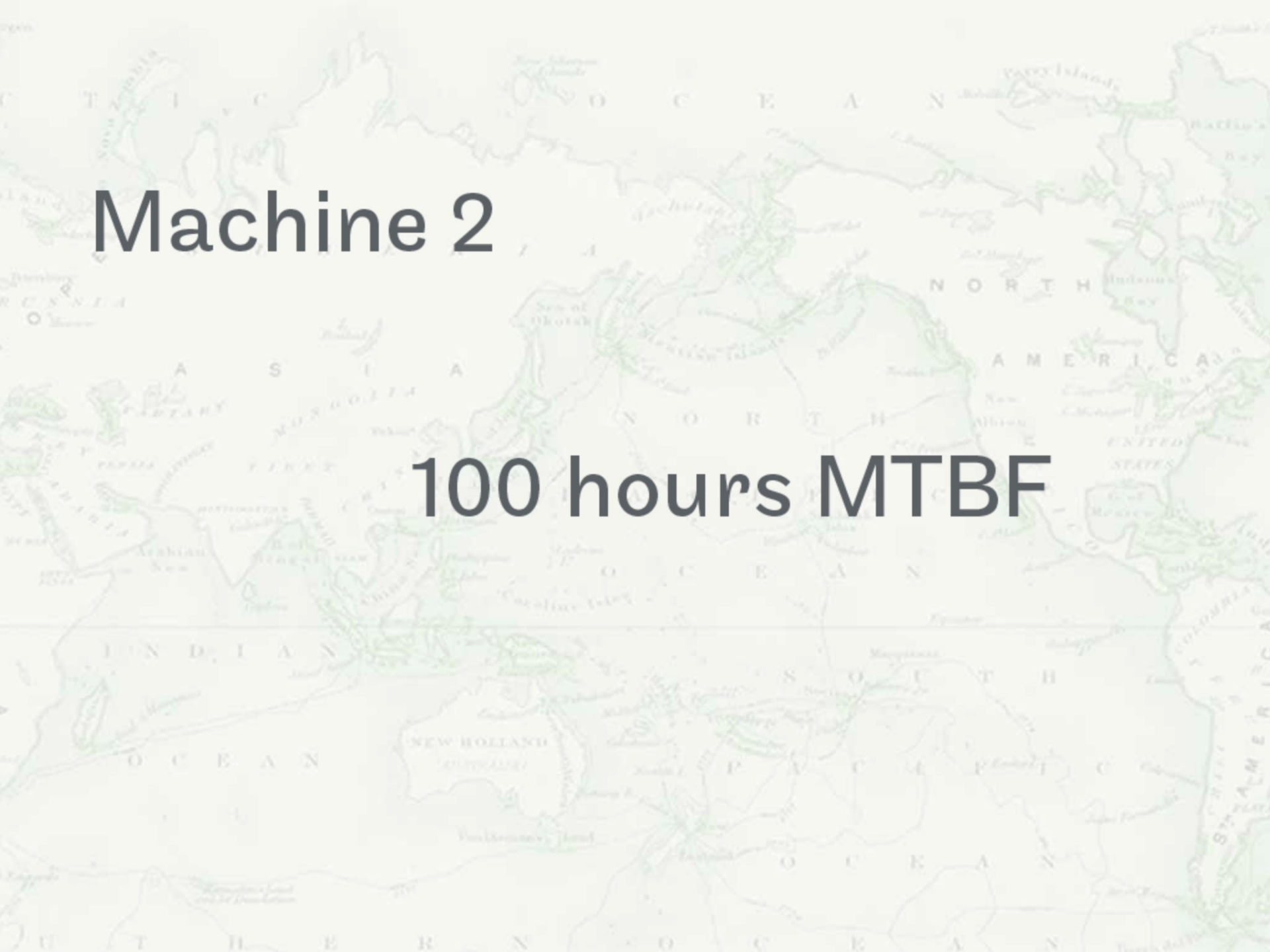
Tally the operating hours and divide by
the number of failures.

all three have run for 1,000 hours



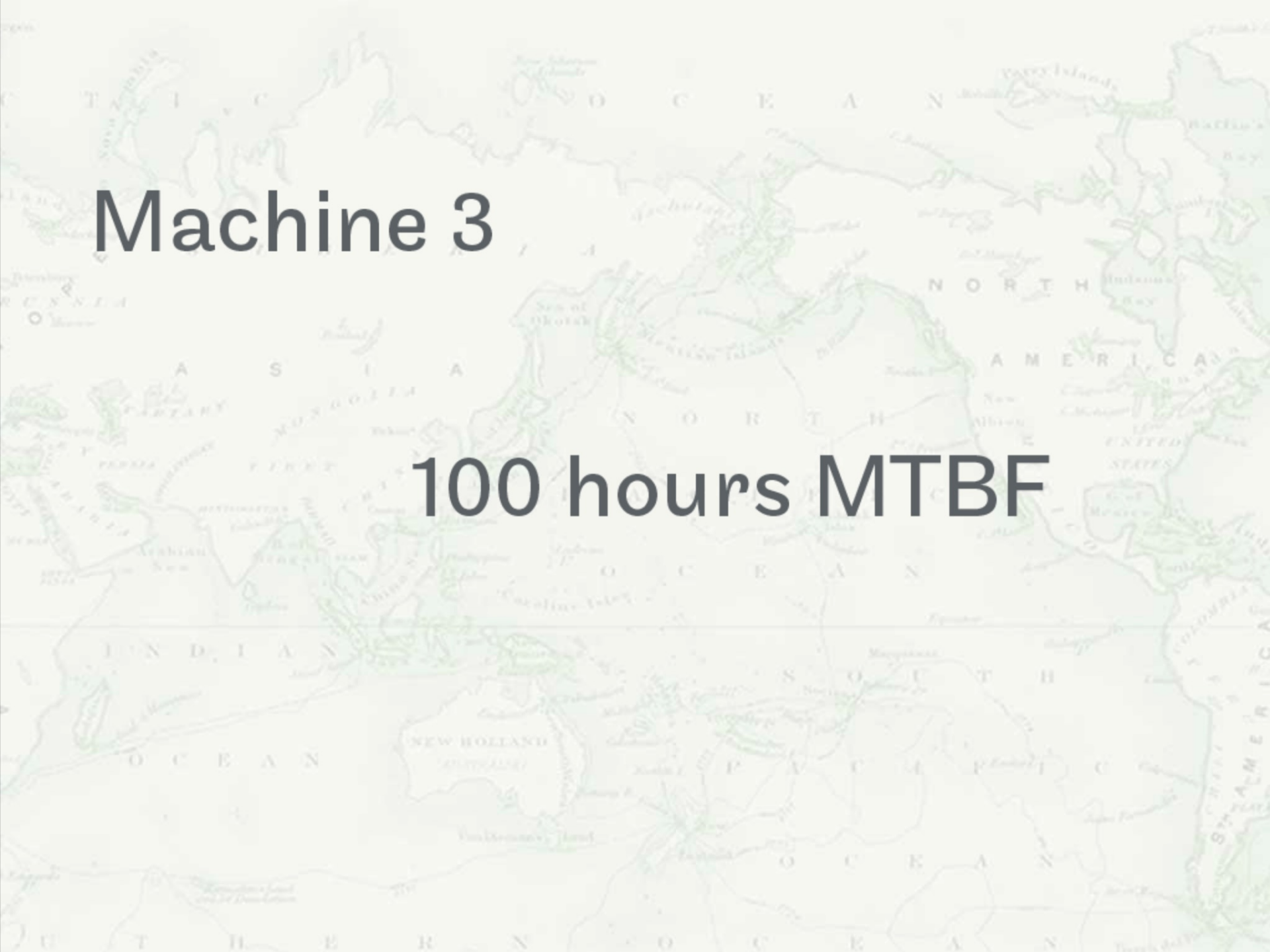
Machine 1

100 hours MTBF



Machine 2

100 hours MTBF



Machine 3

100 hours MTBF

One way to view the data



Did you know about dotplots or stripcharts?

A one dimensional plot of a set of data

Even a simple plot helps

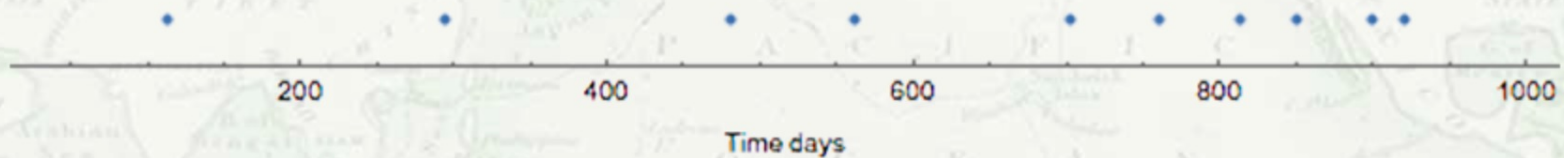
Machine 1

Machine 1 Failures Over Time



Machine 2

Machine 2 Failures Over Time



Machine 3

Machine 3 Failures Over Time



Let's Look at the Data a
little closer

We should let the data story unfold



Cumulative Plot



Three Examples



Other Examples

Cumulative Plot



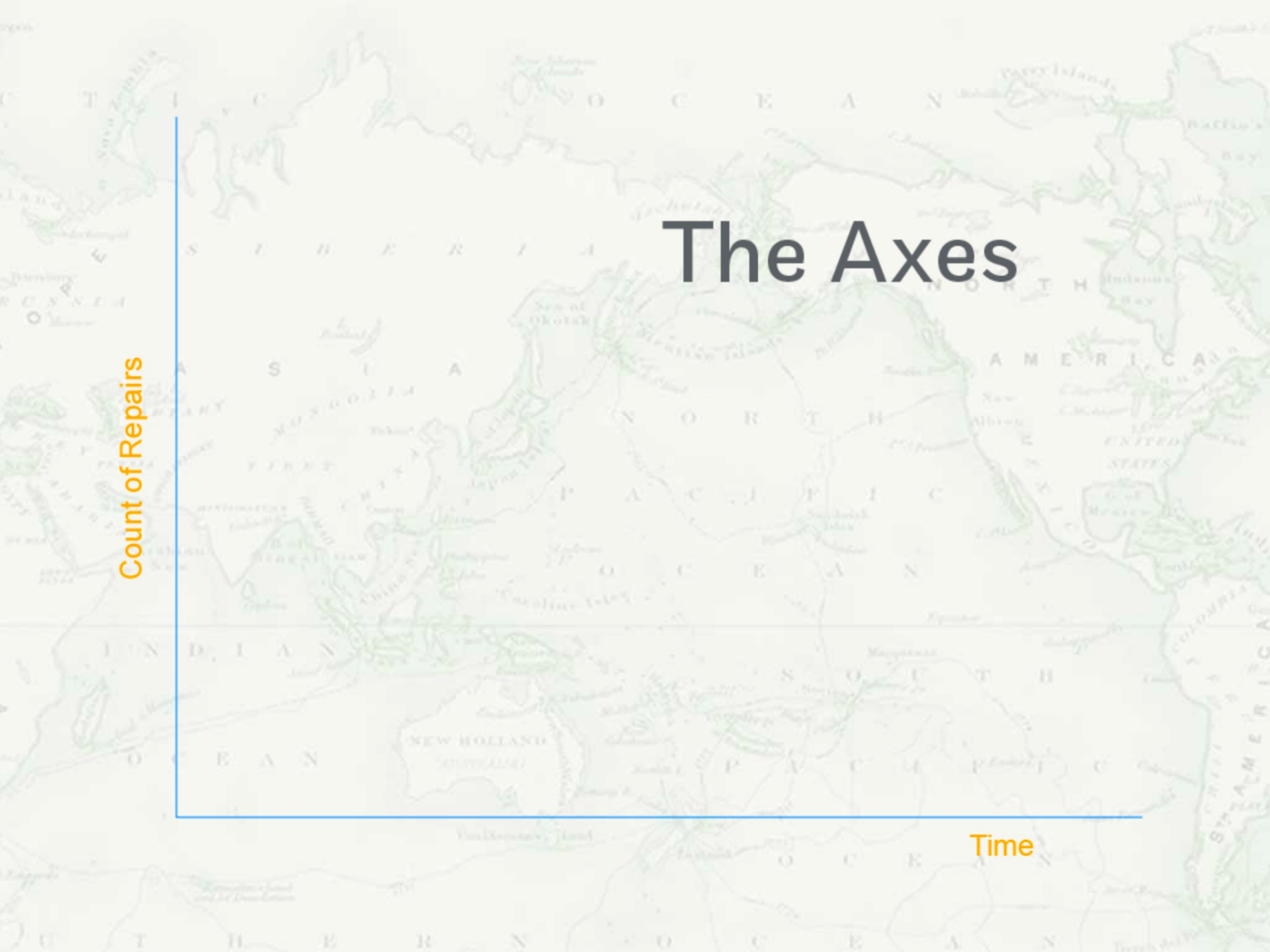
So easy, you can even use
Excel

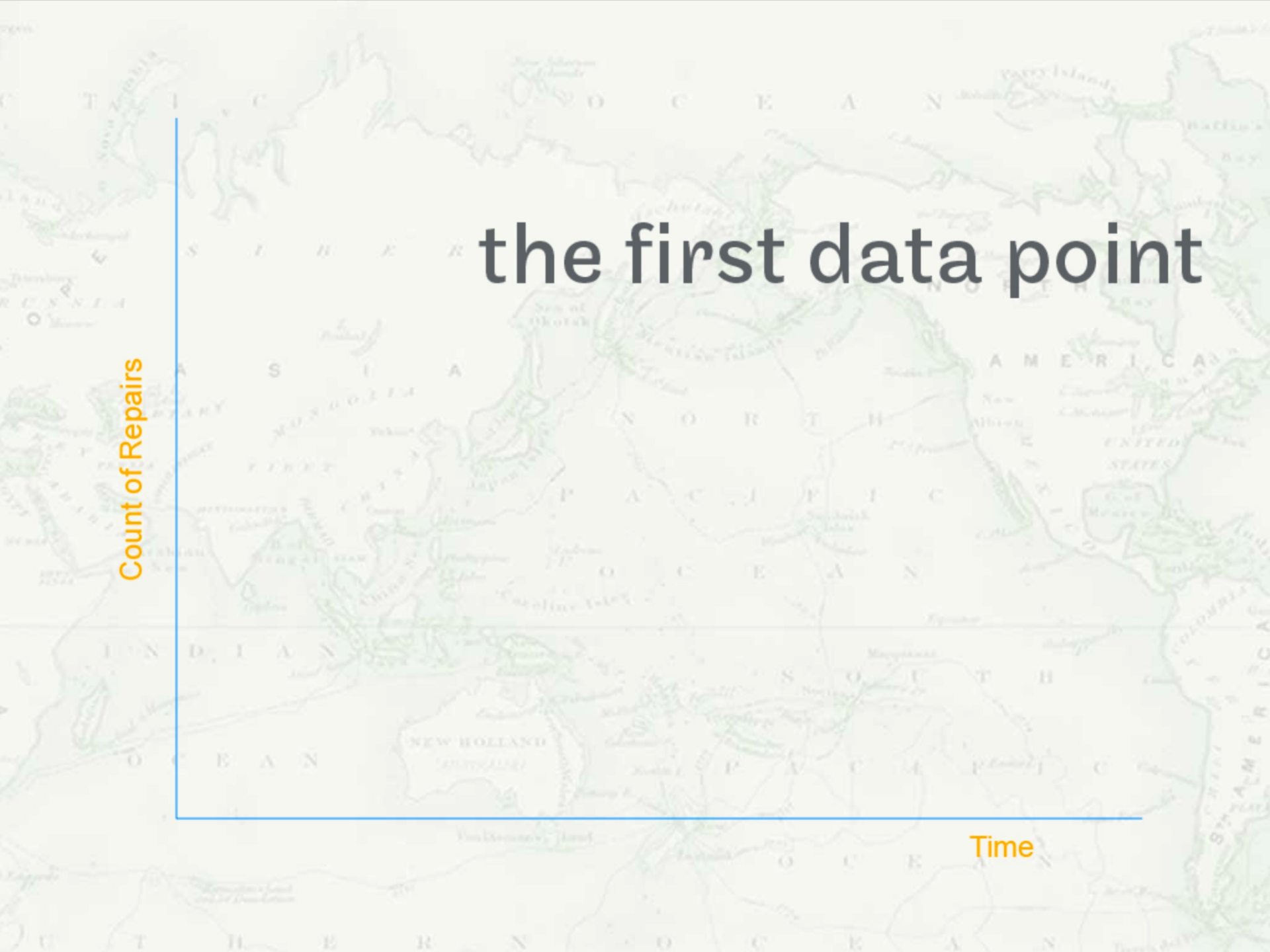
Plot the count of failures, cumulatively,
against time

The Axes

Count of Repairs

Time





the first data point

Count of Repairs

Time

the second data point

Count of Repairs

Time

Our 3 Machines



What do you see or
question do you have

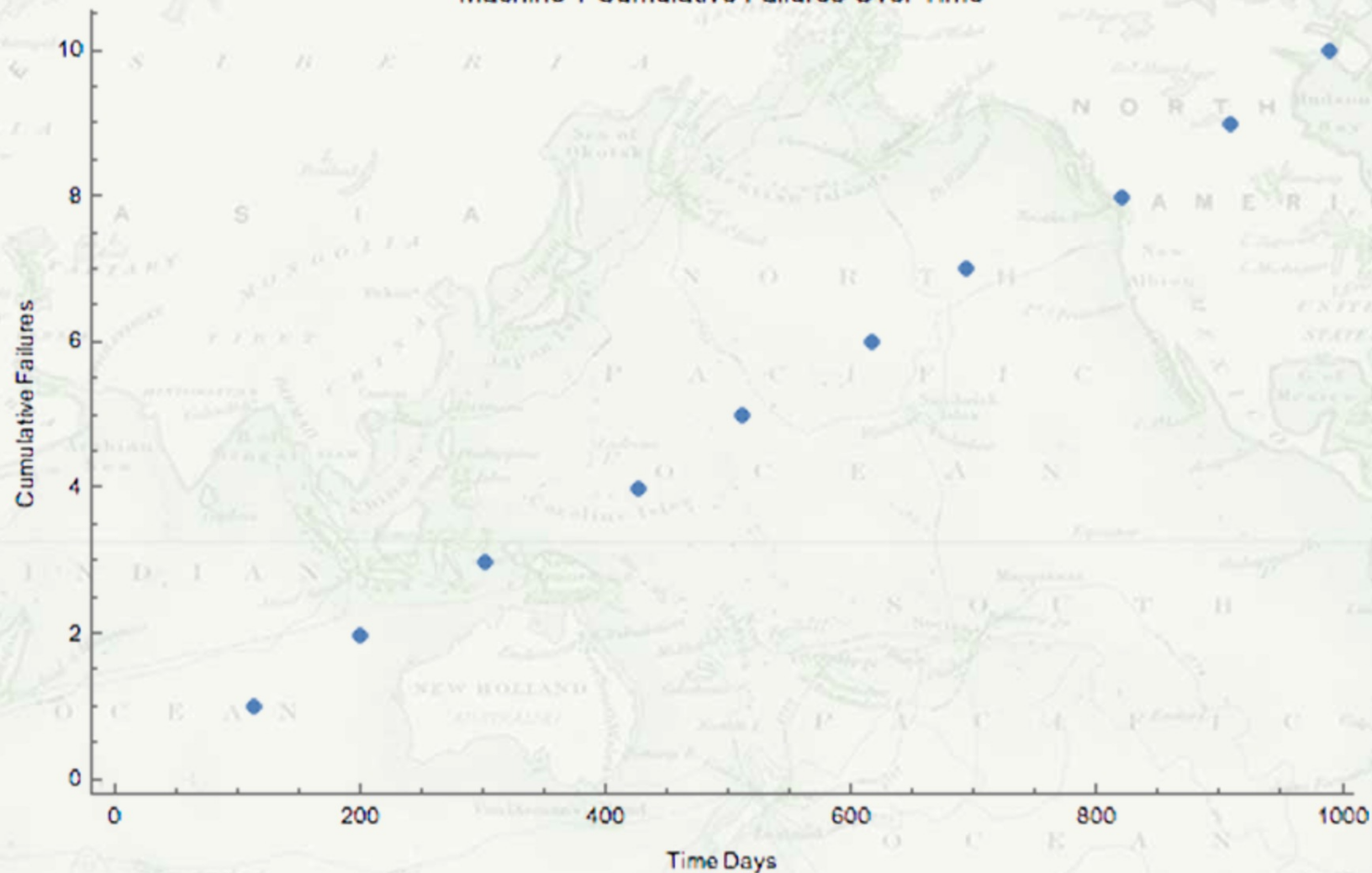
Completely without assumptions.

Just the data over time

What questions come up when you see
these plots?

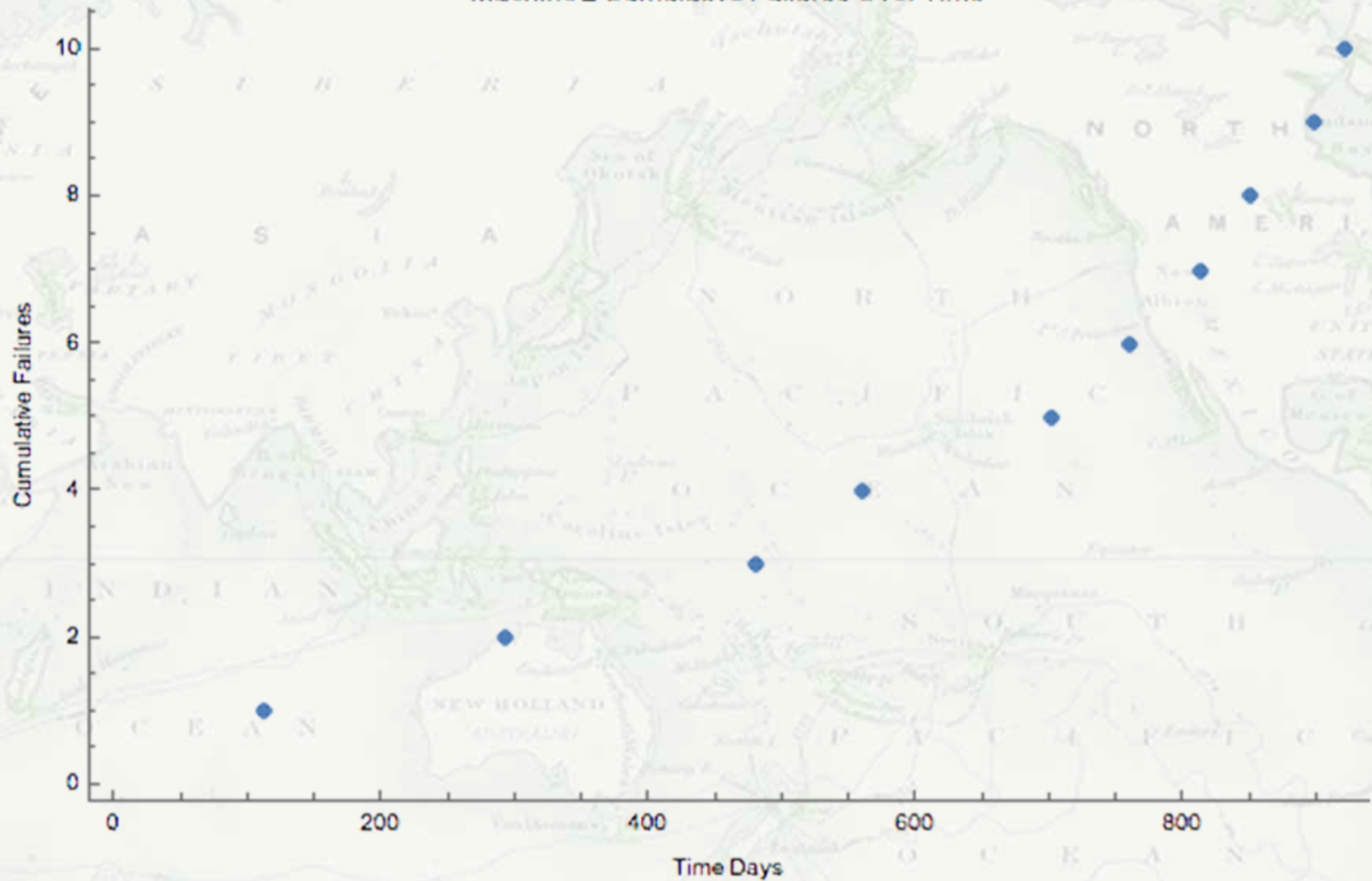
Machine 1

Machine 1 Cumulative Failures Over Time



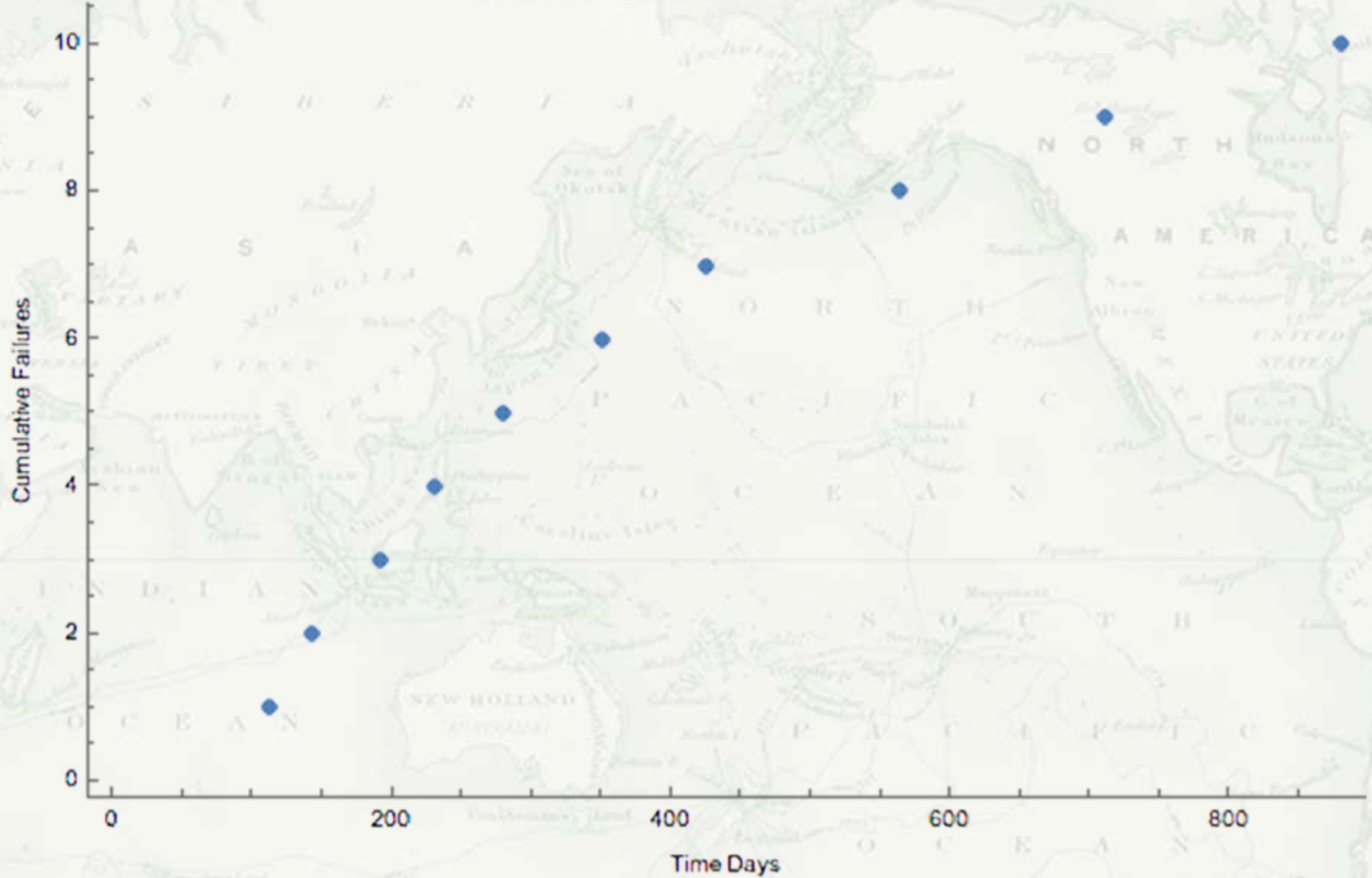
Machine 2

Machine 2 Cumulative Failures Over Time



Machine 3

Machine 3 Cumulative Failures Over Time



Other Examples

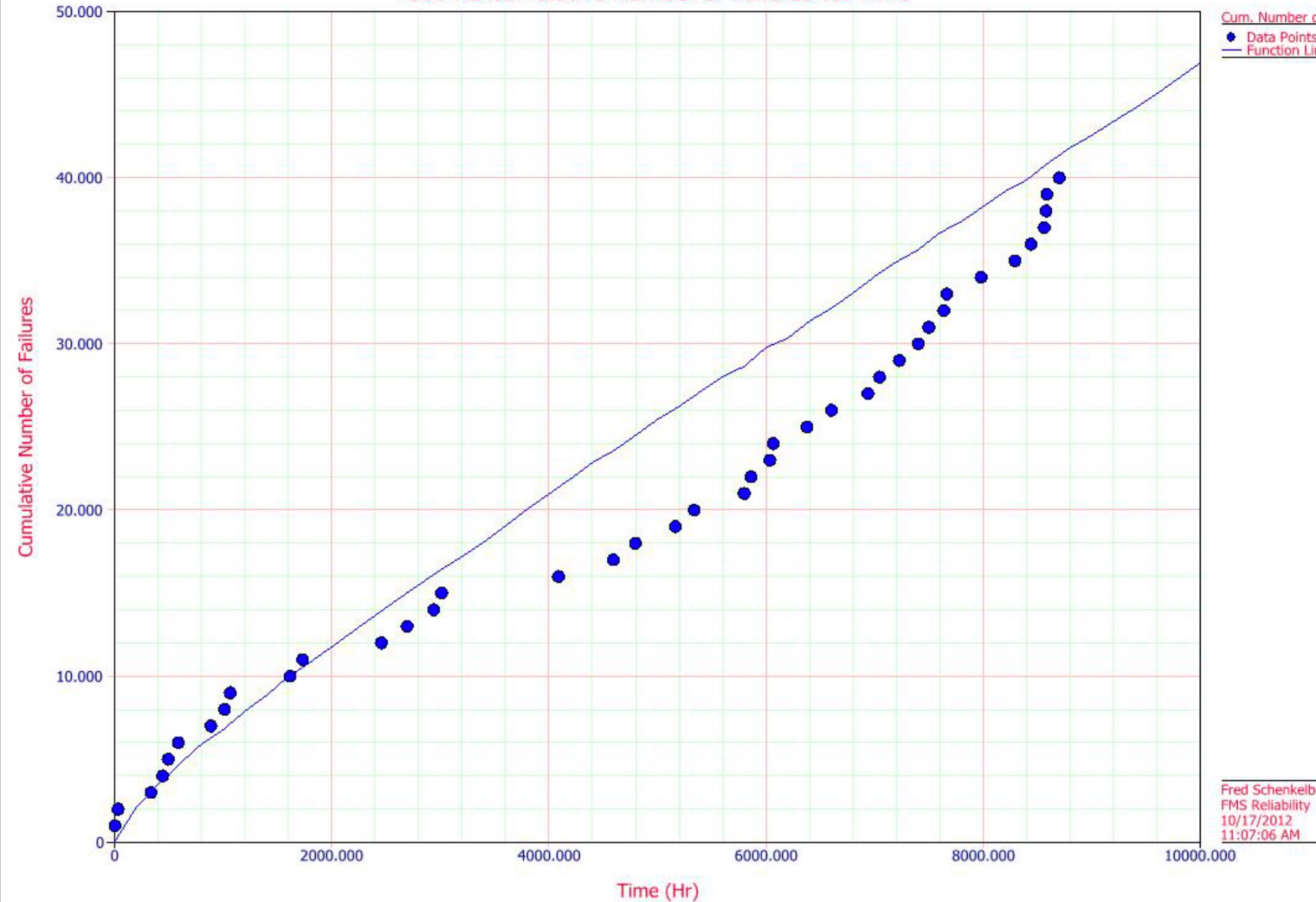


What does the data say in each of these examples?

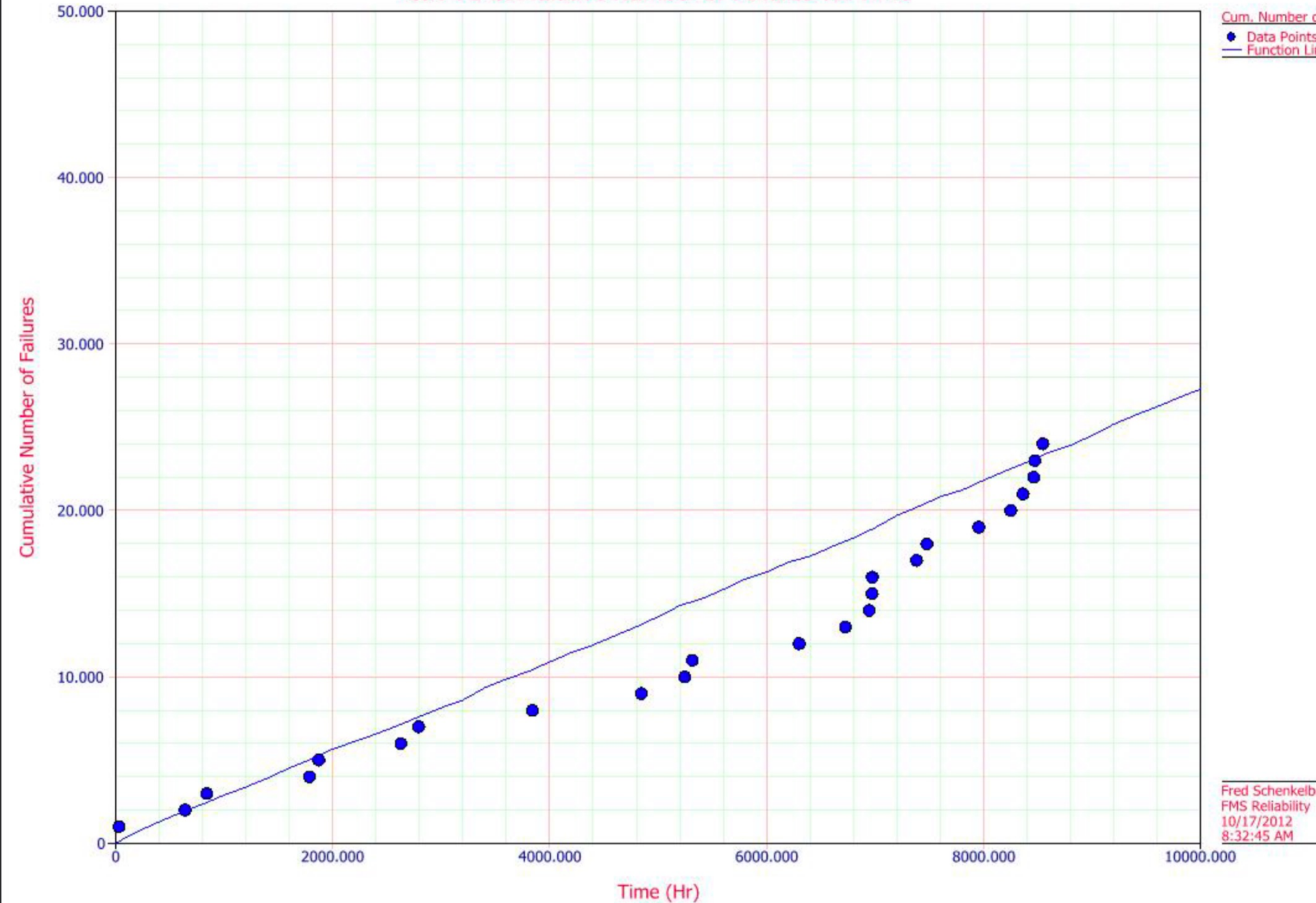
Data is messy, yet may be revealing

The patterns can reveal the next set of questions you should examine.

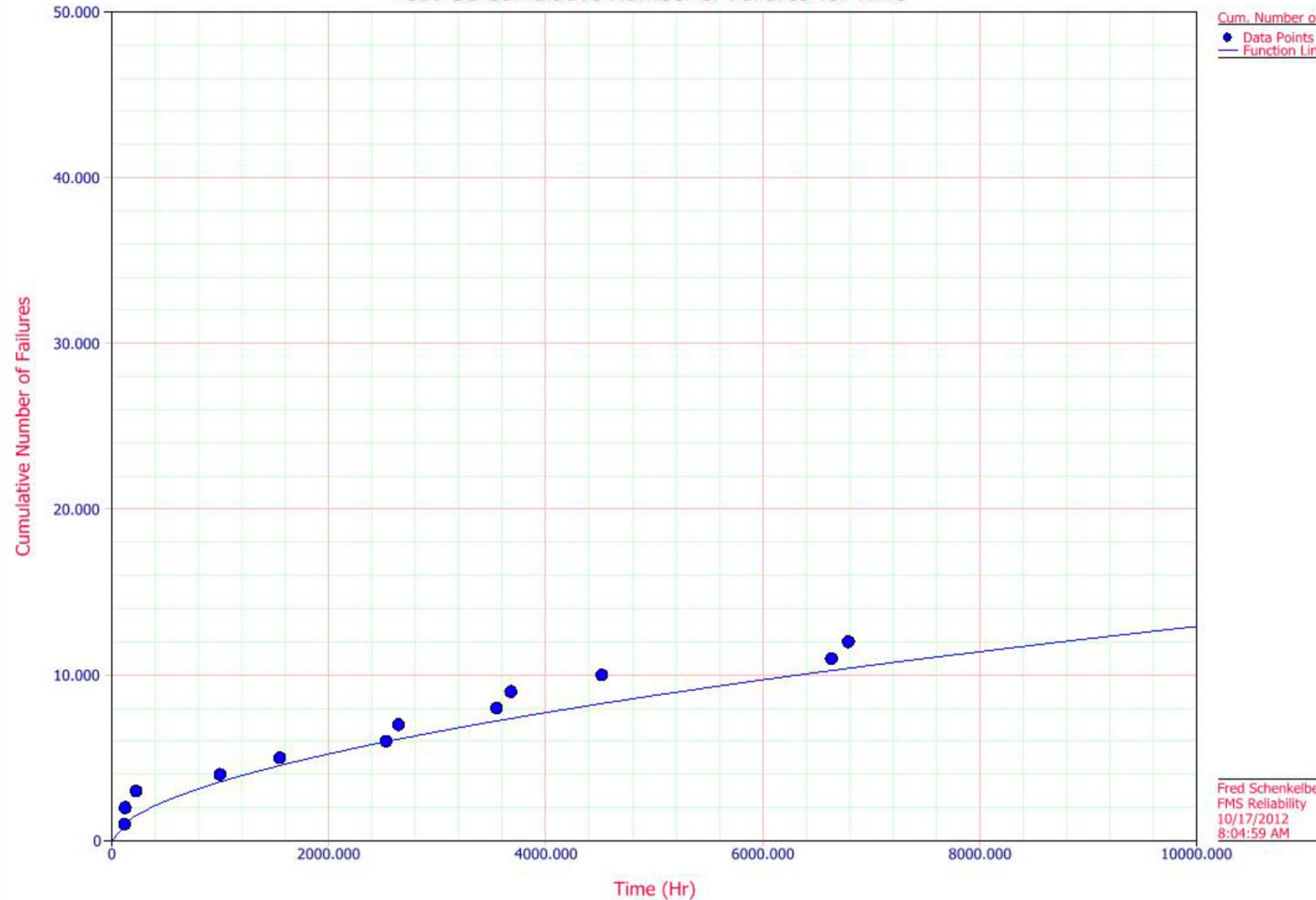
C60-P2 Cumulative Number of Failures vs. Time



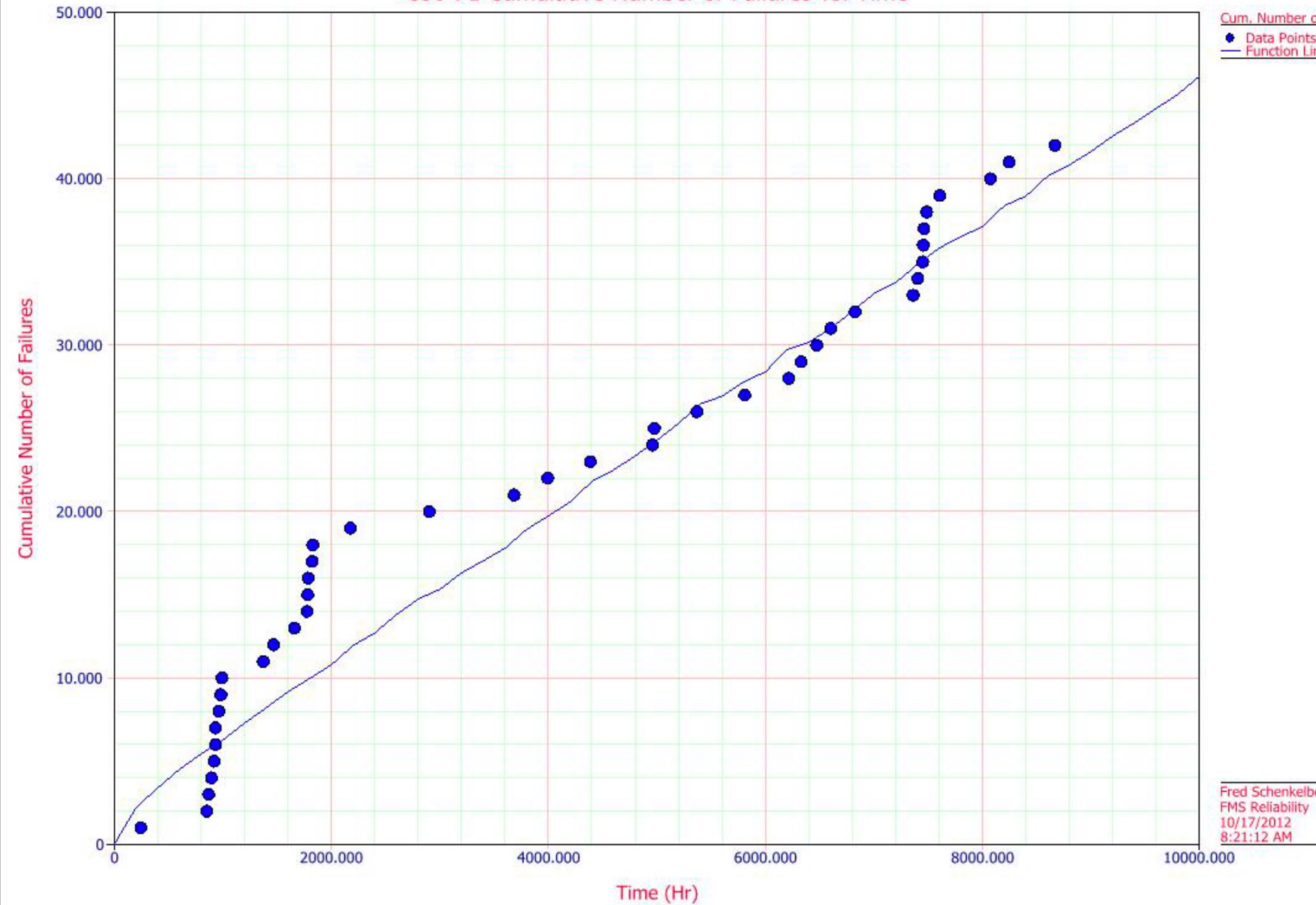
C50-P1 Cumulative Number of Failures vs. Time



C10-S1 Cumulative Number of Failures vs. Time



C30-P1 Cumulative Number of Failures vs. Time



Cum. Number of Failures

Fred Schenkelb
FMS Reliability
10/17/2012
8:21:12 AM

Next Steps



The analysis will lead to better questions.

Improve the data sources

Focus failure analysis

Match estimates to actual

Connect to business objectives

Refine fitted models

Play 'what if' with available information

More Information

Visit AccendoReliability.com

Let me know if you have any questions.

Check out the new reliability engineering podcast network at Reliability.FM

Continue to explore your data and make improvements.