



# Reliability Apportionment and How to Do It

Fred Schenkelberg

# Reliability Goal



Happy  
Customer



Fred, Fred, ...

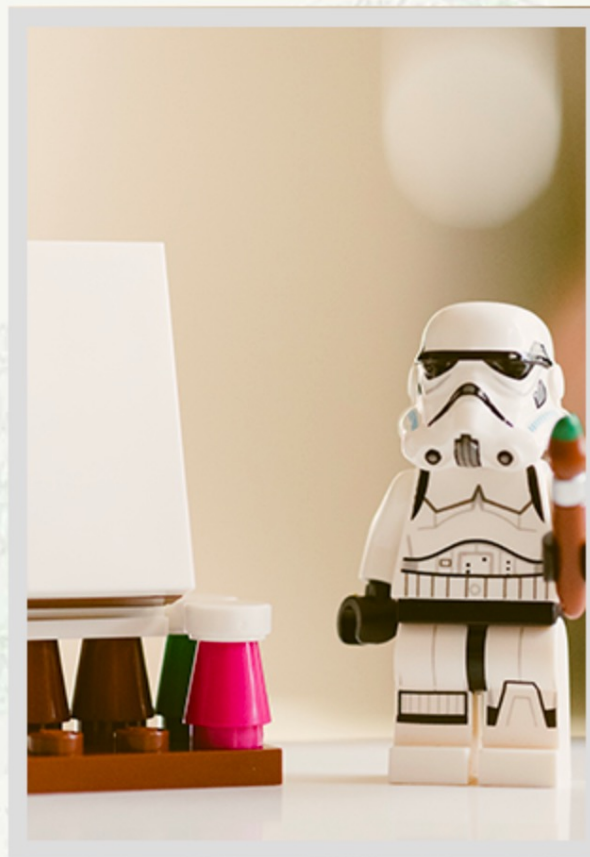


Why else do you  
need to apportion

# What is Apportionment



A Reliability Budget



Subsystem Goals



A Reliability Model

# A Reliability Budget



Like a cost budget, yet  
different

Everything will fail

Different probabilities of failure

Different environments

Different use profiles

What do you  
budget?



# Subsystem Goals



Make the goal specific to the decision making level

Module

Major component

Specific subsystem

Cover every element

How do you  
include  
software?



# A Reliability Model



A way to compare goals to  
knowledge about your  
system

Top down allocation of goals

Bottom up comparison of estimates

How do you  
craft your  
model?





**Function  
Design Team  
Supplier  
Location in System  
Bill of Materials**

Do you need a fancy  
apportionment process?

# How to Do Apportionment



Guess



Use Historical Data



Refine, Update, Revise

# Guess



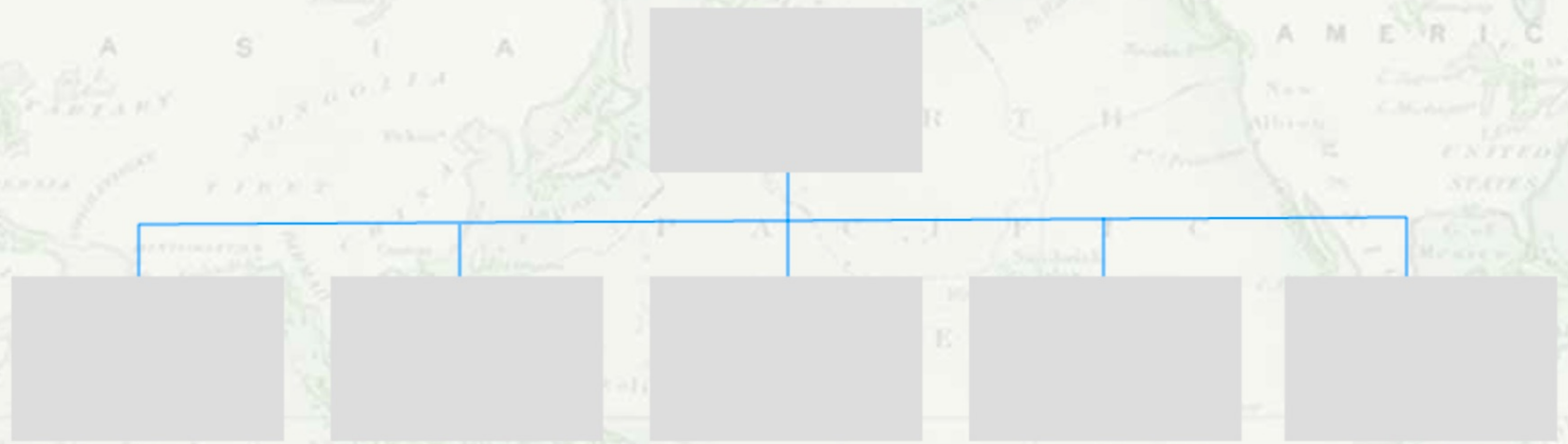
Straight line allocation

Based on experience

Make something up to get started

Break down the system goal

# A simple example



# Use Historical Data



Make use the knowledge  
you have available

Field data has another use

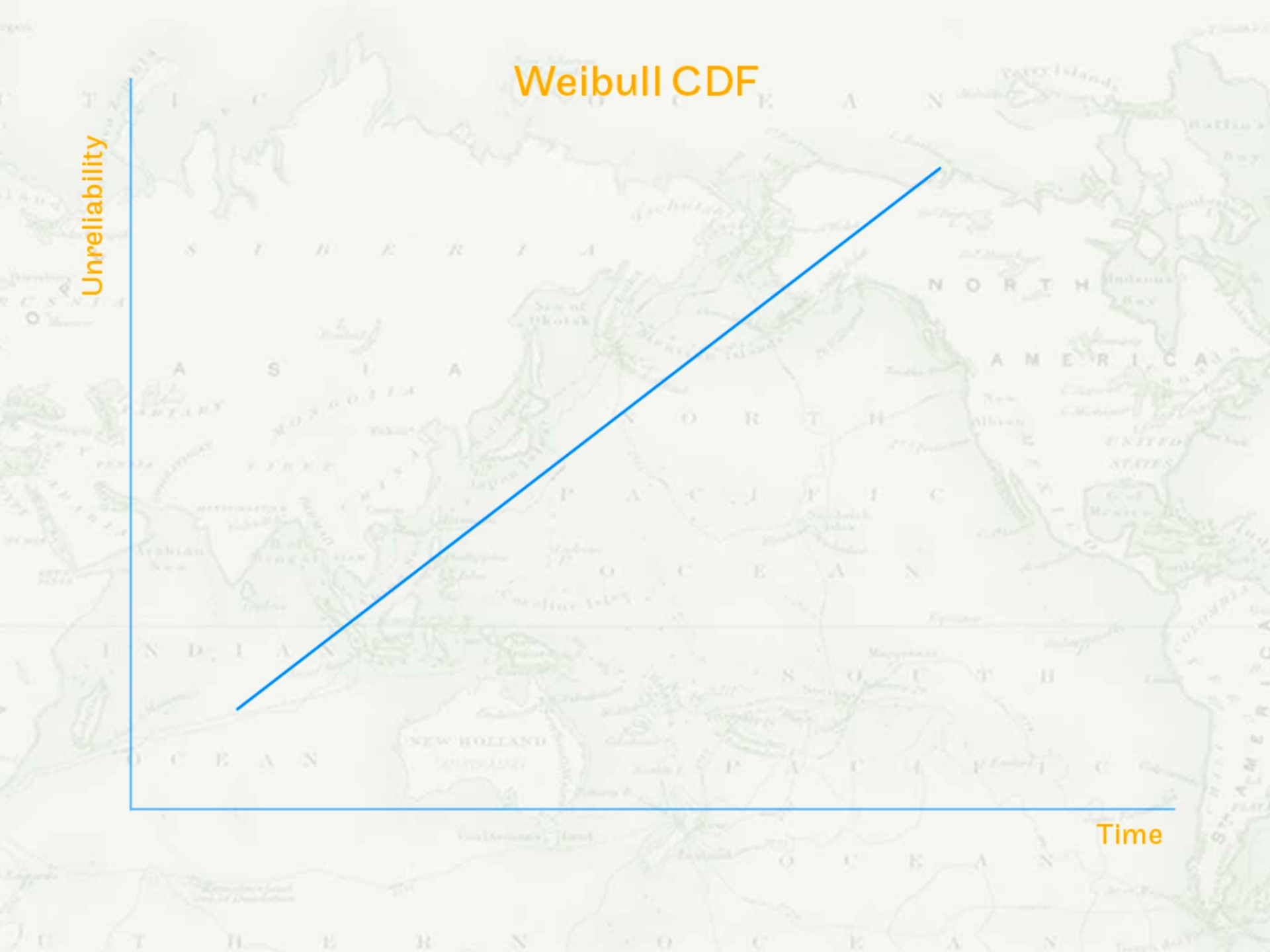
Check different durations of interest

Judge how similar to current design

# Weibull CDF

Unreliability

Time



# Refine, Update, Revise



Engineering modeling/estimates

Supplier information

Testing results

Apportionment is not a one time activity

When would you change  
the system reliability goal?



# Setting goals and comparing to estimates

# Best Uses of Apportionment



## Subsystem Testing



## Supplier Discussions



## Making Decisions

# Subsystem Testing



Higher reliability targets

Different set of stresses

Different use profiles

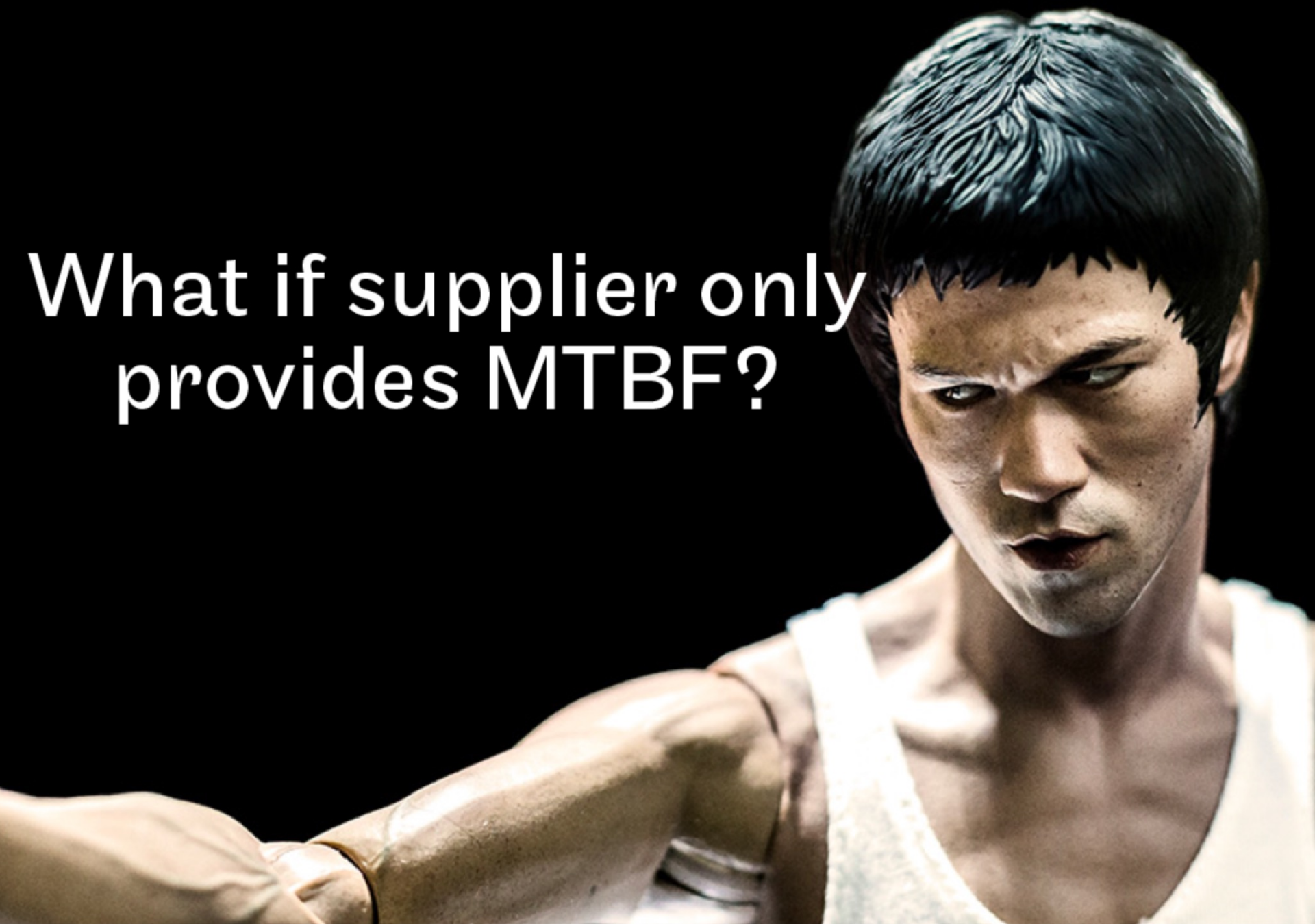
Yes, you may need more samples

How do you eat an elephant?





What if supplier only  
provides MTBF?



# Making Decisions




Apportionment alone is  
not useful

Set the conditions to enable good  
decisions

Selecting parts or design options

Balancing priorities for reliability  
improvement

The weakest link approach

A collection of colorful toy cars and motorcycles, including a yellow car, a blue car, a green car, and a red motorcycle, are arranged on a light blue wooden surface. The background is blurred, showing more toys and a white wall.

How does your team use  
apportioned reliability  
information?

# Summary

System Reliability Goals

Make Decisions



Break down goals to system elements



Update estimates  
& make adjustments



# More Information

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Let me know if you have any questions.

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