

# **“Improving Reliability and Performance of Offshore Structures through better Lifecycle Engineering Data”**

**by**

**Ir. Abdul Malik Hussein bin Abdul Jalil  
Sr Mechanical Engineering Consultant  
Caidmark Sdn Bhd**

**Tuesday, 6<sup>th</sup> October 2015  
Impiana Hotel KLCC**

# Definition of Reliability

**Reliability** may be defined in the following ways:

- The idea that an item is fit for a purpose with respect to time
- The capacity of a designed, produced, or maintained item to perform as required over time
- The capacity of a population of designed, produced or maintained items to perform as required over specified time
- The resistance to failure of an item over time
- The probability of an item to perform a required function under stated conditions for a specified period of time
- The durability of an object.

[https://en.wikipedia.org/wiki/Reliability\\_engineering](https://en.wikipedia.org/wiki/Reliability_engineering)

# Definition of Reliability

# TIME!!!



# Why the concern in time?

# Definition of Reliability



# What is Lifecycle Engineering Data?



- Populating lifecycle engineering data from design software**
- Using lifecycle engineering data to help engineers optimize performance of offshore structures**
- Using lifecycle engineering data to better detect and avoid structural failures**
- Using lifecycle engineering data in simulation tools to predict life of offshore structures**
- Technology and expertise that is available in Caidmark to manage lifecycle engineering data**

# Populating Lifecycle Engineering Data from Design Software

## Typical Asset Information

- Equipment Data Sheets
- Asset Hierarchy, Register
- Tag numbers
- Maintenance Strategies
- Criticality Rankings
- Reliability Centered Maintenance FMEAs
- Maintenance Activities Lists
- Maintenance Job Routines
- Corrosion Inspection Job Routines
- Consolidated Bill of Materials
- Spare Parts & MRO Lists
- Operations Procedures
- Commissioning, Startup Strategy, Plan, Procedures
- Training Manuals
- Maintenance Manuals
- As-Built Drawings
- Equipment Baselines

Span of Lifecycle Engineering Data



Design Software



**Relevant Lifecycle Engineering Data**

# Populating Lifecycle Engineering Data from Design Software

- **Selection of Materials**
- **Standard Material Codes**
- **Standard Material Properties**
- **Managing Design of Structure or Asset**
- **Simulating Reality**



# Using Lifecycle Engineering Data to help Engineers Optimize Performance of Offshore Structures

Performance of Structures



Maximize Usage

Maximize Life

Lifecycle Engineering Data to Monitor

# Using Lifecycle Engineering Data to help Engineers Optimize Performance of Offshore Structures

STRENGTH

FATIGUE LIFE

What Data from Design Point of  
View?

RELIABILITY

FAILURE

DURABILITY

# Using Lifecycle Engineering Data to better Detect and Avoid Structural Failures

## Probable Cause of Structural Failures



Fatigue

Over Utilized

Wrong Design

Wrong Material  
Selection

Impact

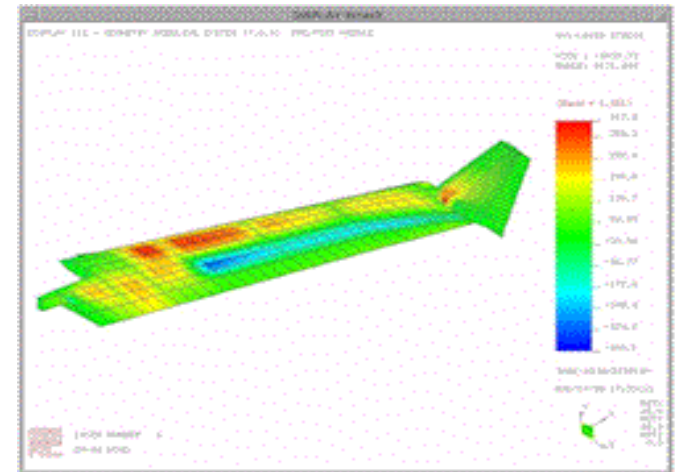
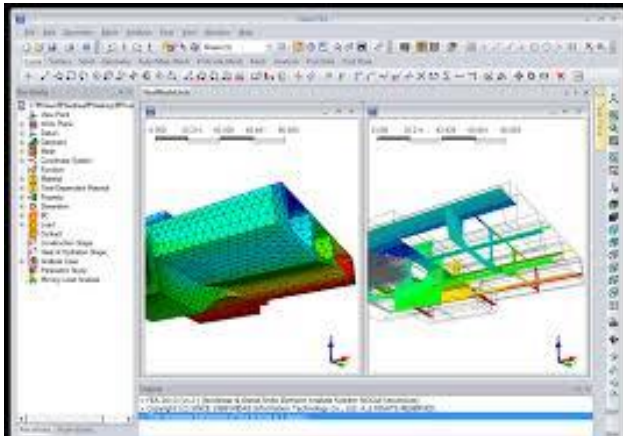
Poor Workmanship

Wrong Operating Procedures

# Using Lifecycle Engineering Data to better Detect and Avoid Structural Failures

Can 80% of Structural Failures be detected and avoided with better information of design Lifecycle Engineering Data?

YES

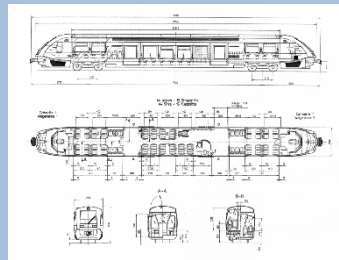


# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

Product  
Development  
Evolution  
(Past)

Source: Presentation by Andrew Currie, Director,  
South Asia, MSC.Software, 2005

Physical Test  
and Redesign



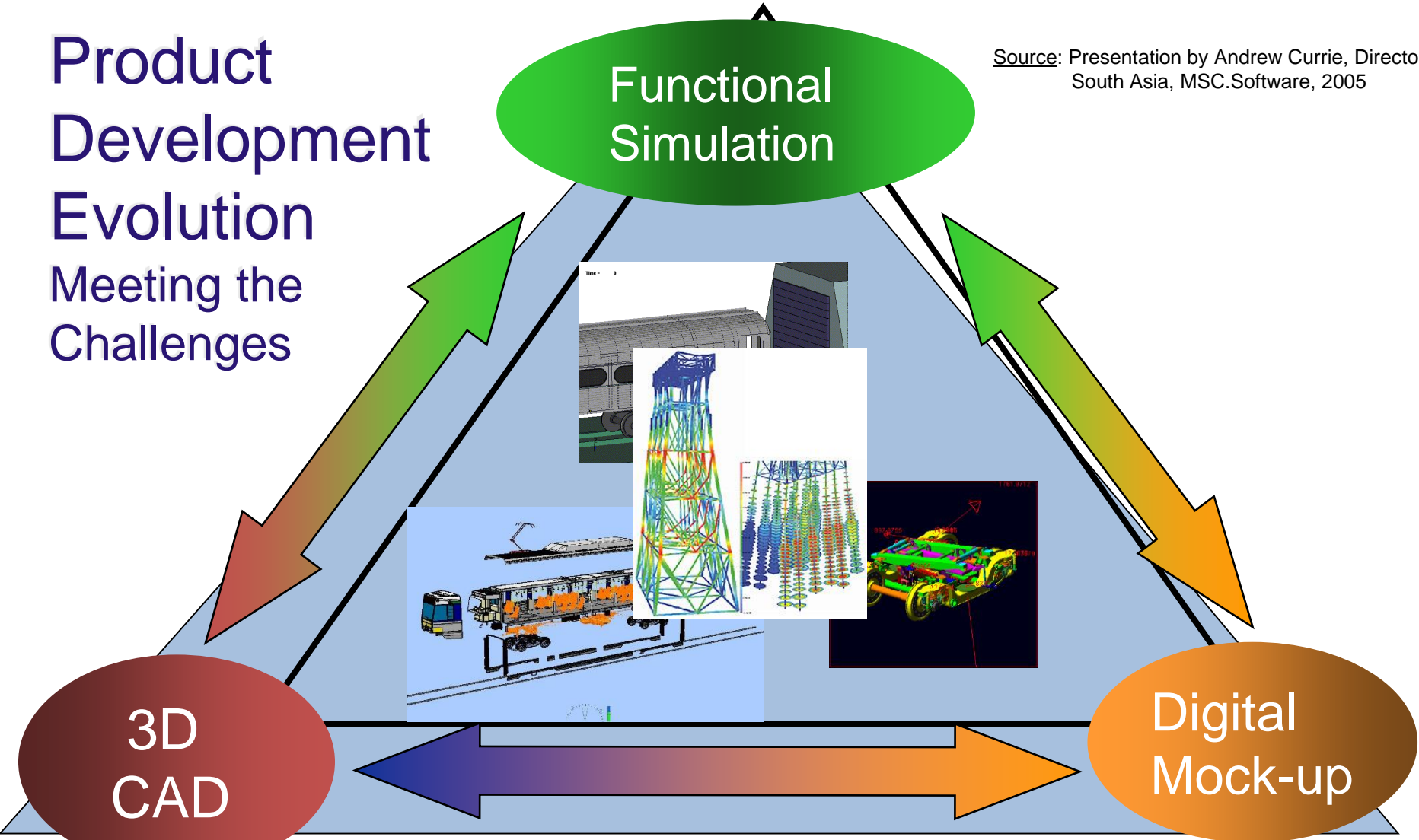
Manual  
Drafting

Physical  
Prototype

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

Product  
Development  
Evolution  
Meeting the  
Challenges

Source: Presentation by Andrew Currie, Director,  
South Asia, MSC.Software, 2005

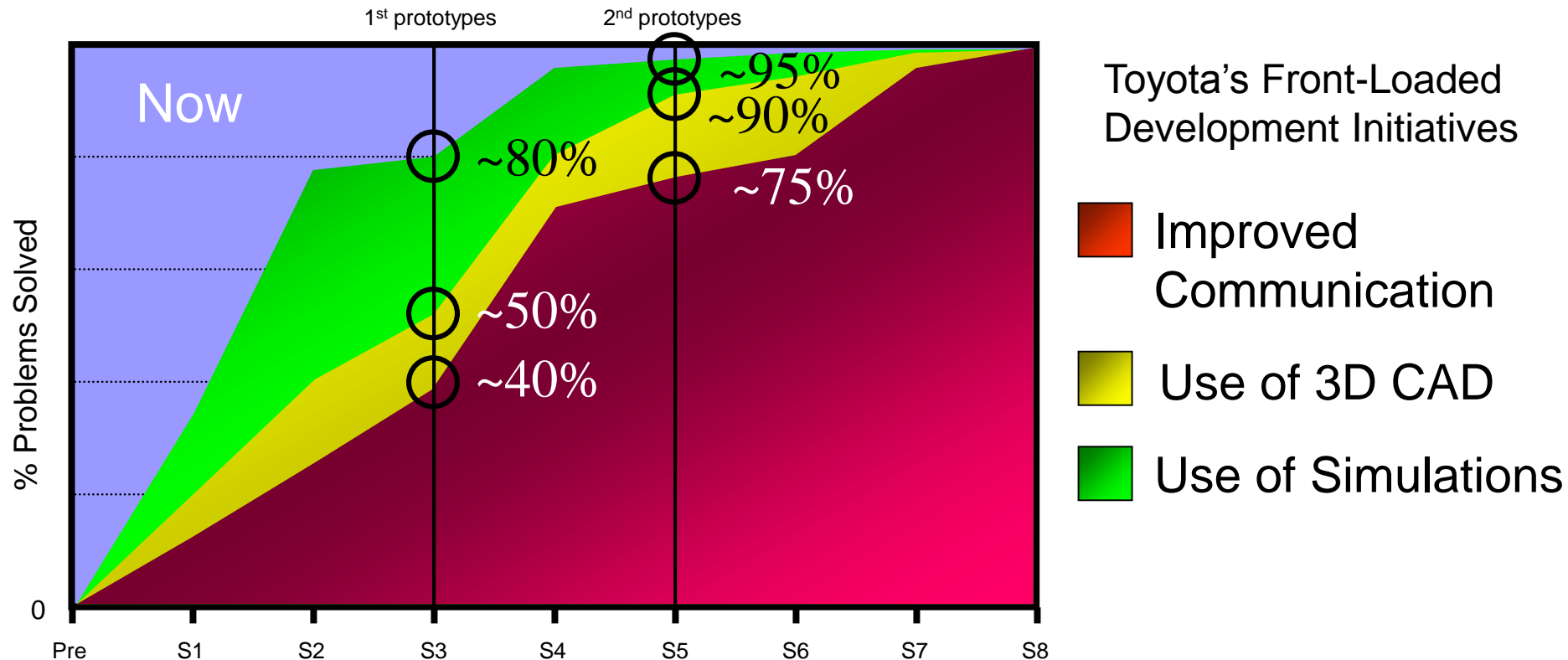


# What are the Benefits of Simulations?

- Simulation is the effective use of virtual product models to make critical product decisions throughout the new and operating product development process
- Simulation enables improved product quality, faster time to market and reduced cost through the efficient use of people, processes, tools, and data

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

## Innovation Through Simulations



Source: Toyota Motor Company Presentation  
Traverse City, MI Automotive Conference

Stages of Development Process



# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

## What Is the Return on Investment?

- Returns:
  - Fewer trials and errors.
  - Less material waste.
  - Confidence in manufacturing process.
    - “Get it right the first time.”
  - Improved quality.
  - Reduced time to market and operation.
  - Lower overall manufacturing cost.

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

*How do we apply  
Simulations to real world  
problems?*

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

Multiple Disciplines:  
Streamlined & Integrated

**Will it work?**

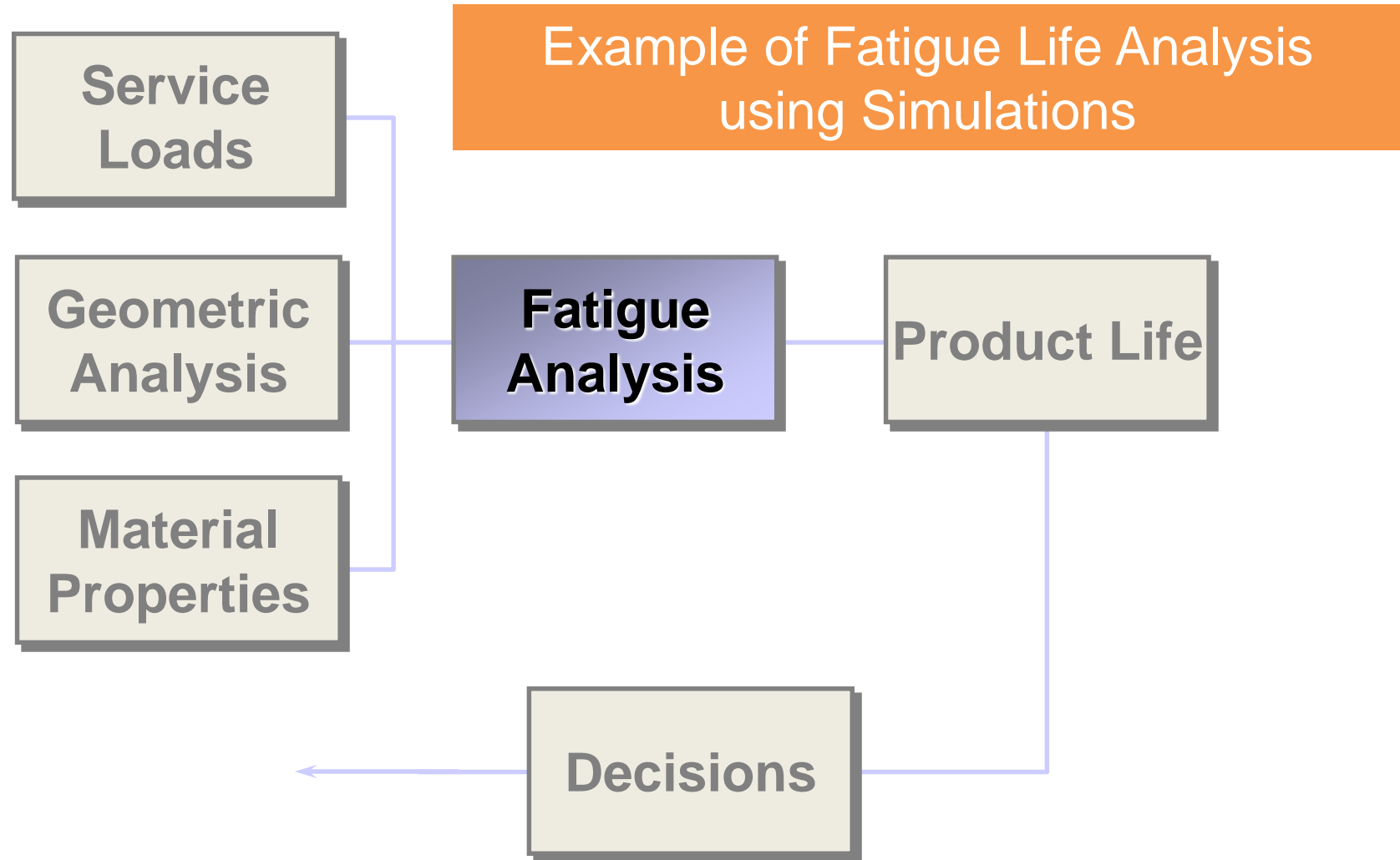
**Will it break? Will it last?**

**Will it operate safely?**

**Will it meet comfort requirements?**

**Can we make it?**

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures

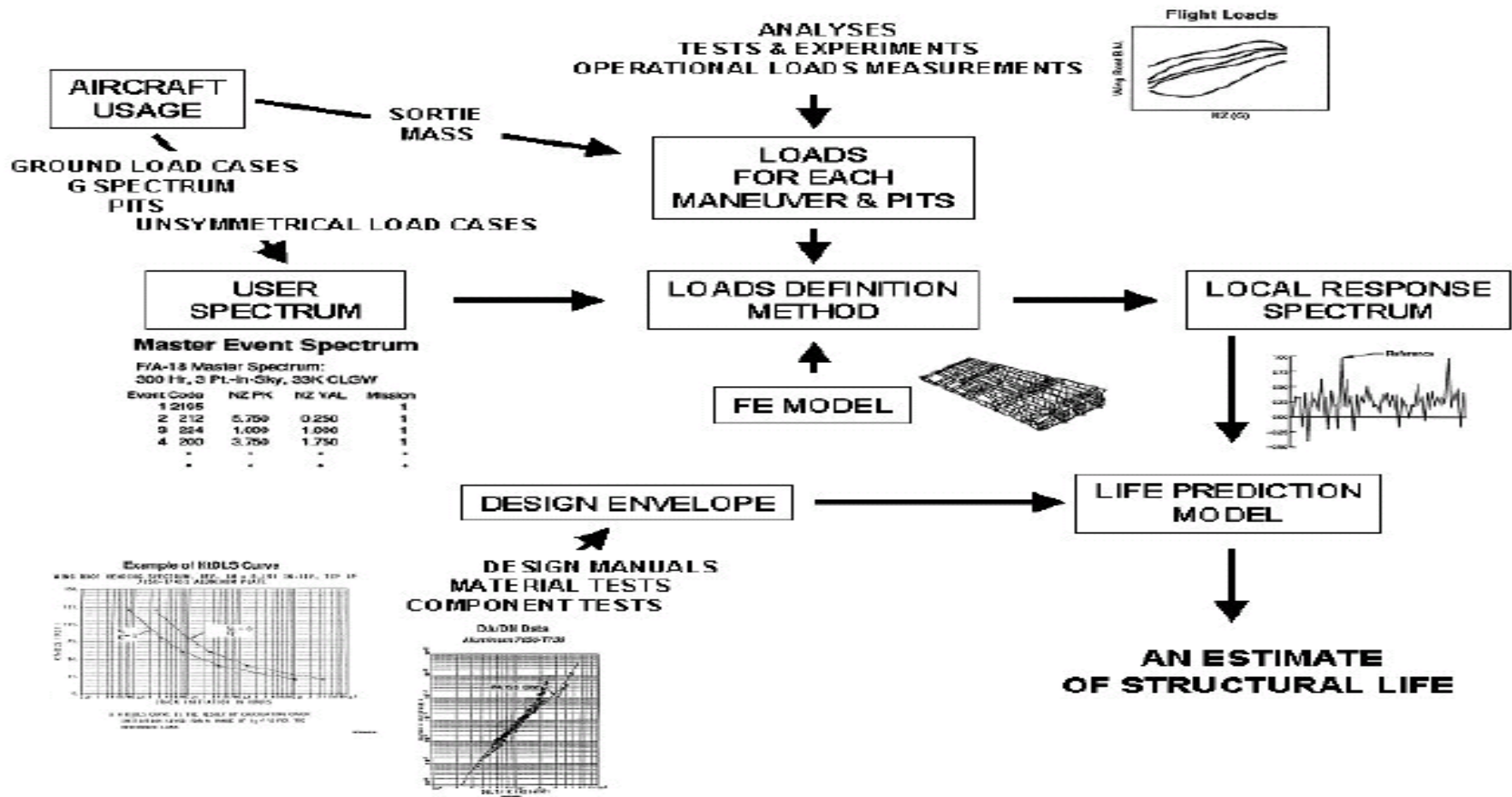


# *WHAT IS FATIGUE?*

- Failure under a repeated or otherwise varying load which never reaches a level sufficient to cause failure in a single application.
- The initiation and growth of a crack, or growth from a pre-existing defect, until it reaches a critical size.

***Fatigue cracks initiate and grow as a result of cyclic plastic deformation***

# Using Lifecycle Engineering Data in Simulation Tools to Predict Life of Offshore Structures (From an Aircraft Structure Point of View)



# Experience working with the Royal Malaysian Air Force

## TIME TO WALK THE TALK

# *CAIDMARK SDN BHD*

## ENGINEERING & IT SERVICES

Incorporated : 30 APRIL 1986



2014  
Celebrating Malaysia's  
Enterprising Spirit



CERTIFIED TO ISO 9001:2008  
CERT. NO. : AR3213

MS ISO 9001 : 2008 REG. NO. AR 3213

SME Corp SCORE: (4) ★ ★ ★ ★

1-InnoCERT - AA

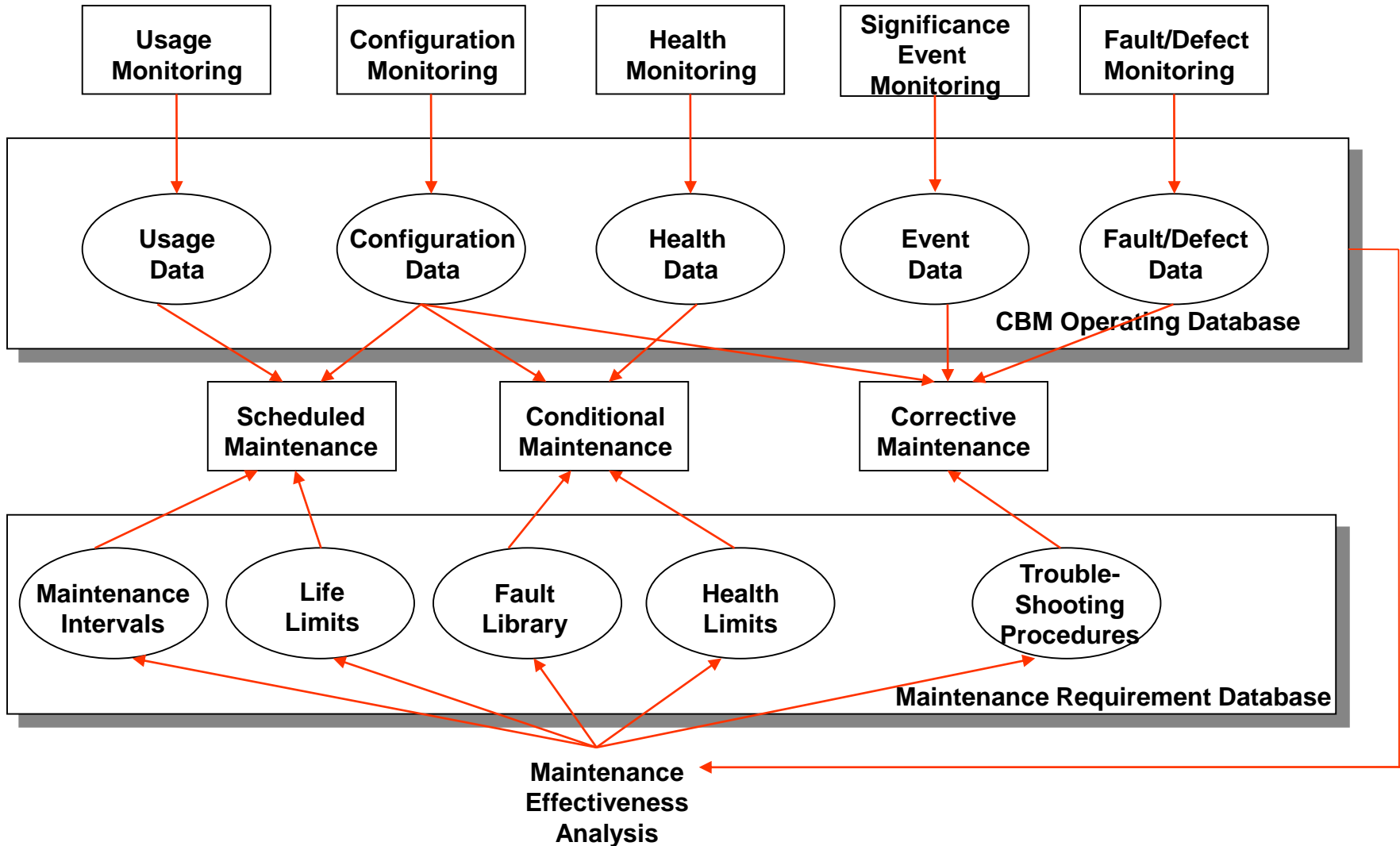
SME Innovation Award 2014

(Winner for ICT & Software Development Category)

Updated on 19 January 2015



# CONDITION BASED MONITORING



# Technology and Expertise that is available in Caidmark to Manage Lifecycle Engineering Data

## CAIDMARK TECHNICAL & INDUSTRIAL NICHE AREAS

### CAIDMARK SOLUTIONS & PRODUCTS

DATA  
ACQUISITION

CAD/CAE/CFD

PHYSICS OF  
FAILURE

3D E-LEARNING

MARINE

CONTROL &  
MONITORING  
SYSTEM

VIBRATION  
MONITORING

RELIABILITY  
MONITORING &  
ANALYSIS

OBSOLESCENCE  
MANAGEMENT

AVIATION

MODELING &  
SIMULATION  
SYSTEM

ATE  
HiL TESTING

CBM  
RCM

LIFE ,VIRTUAL &  
CONSTRUCTIVE  
(LVC)

OIL & GAS

# PRINCIPALS



# THANK YOU

Ir. Abdul Malik Hussein  
[malik@caidmark.com.my](mailto:malik@caidmark.com.my)  
Mobile: +60192386966