



# Reliability Program Overview for Developers

## Design For Reliability - Cookbook

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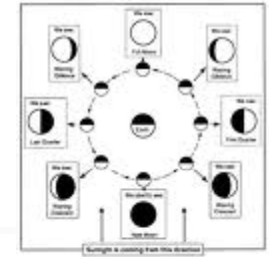
*Amnon Ganot - November, 2010*

# Agenda



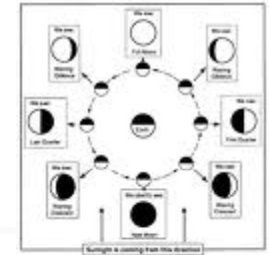
- *Metrics*
  - Reliability
  - Failure Rate
  - MTTF / MTBF
  - Expected Life
  - MTTR
  - Availability
  - Reliability Growth
- *Toolbox*
  - Design
  - Tests
  - Monitor
- *Reliability Assurance Plan*
- *Design For Reliability - Cookbook*
- *summary*

# DFR - Stages



- *Requirements Setting*
- *Design*
- *Tests*
- *Production*
- *Field Use*
- *ECO/FCO*

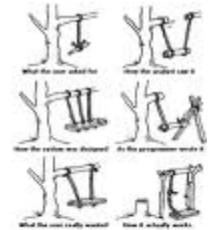
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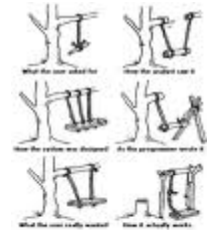
# DFR - *Requirements Setting*



- ***Reliability Trustee*** - Assign a reliability trustee person within the project
- ***Reliability Goals*** - Determine reliability goals to be met
- ***Reliability Objectives*** – Establish measurable reliability objectives that indicate the system has reached acceptable level of readiness for release.

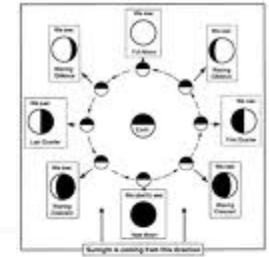


# DFR - *Requirements Setting*



- ***Environment*** – Define operating environment for each sub-system (micro environment)
- ***Failures*** – Clearly define what constitute system failures
- ***Expected Life*** – Establish expected life requirements (time, cycles, etc.) for those parts that have wear-out mechanism

# DFR - Stages



- *Requirements Setting*
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# DFR - *Design*



- ***Simplicity*** - Reduce parts count & interconnections (and their failure opportunities).
- ***Redundancy*** - Provide subsystem redundancy when high reliability is a need.
- ***Proven Components, Materials & Methods*** - Use proven parts, materials & methods with well characterized reliability or that have been shown to work in similar application



# DFR - *Design*



- ***Derating*** – Use derating practice while selecting components
- ***Stress-Strength*** - Design to minimized or balance stresses and thermal loads and/or reduce sensitivity to theses stresses or loads.
- ***FMEA*** - Conduct an FMEA for each subsystem that is either under high stress, or there is no past experience with, or its failure might causes a safety issue.

# DFR - *Design*



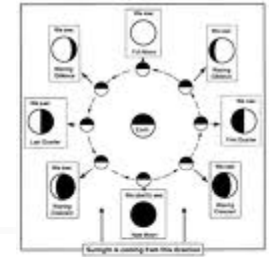
- ***RBD*** – Use Reliability Block Diagram methodology to define the logical interaction of failures within the system.
- ***FTA*** – Use Failure Tree Analysis technique, in cases where the interaction between the system building blocks can not be displayed as a combination of serial and parallel connections.
- ***Reliability Allocation*** – Allocate Reliability metrics using the ARINC method based on the system RBD.

# DFR - *Design*



- ***Testability*** – Design Testability degree to met the project Testability metrics level (FFD, FIT & FAR).
- ***FRACAS*** – Set "Resolution" based on the list of FRUs

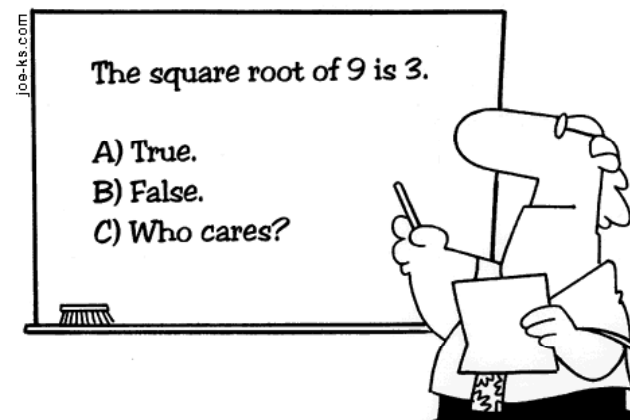
# DFR - Stages



- *Requirements Setting*
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# DFR - *Tests*

- **ALT** - Conduct an ALT to find dominant failure mechanisms and/or when there is a wear-out mechanism involved.
- **HALT** - Conduct an HALT for each subsystem that is either under high stress, or there is no past experience with, or its failure might causes a safety issue.

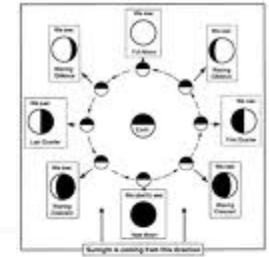


# DFR - *Tests*

- ***RDT*** – Conduct Reliability Demonstration Tests, both on sub-system as well on the system, using the SPRT method, to validate reliability goals had been achieved.
- ***Reliability Growth Plan*** – Conduct Reliability Growth Plan when system is being launched before reliability goals have been achieved



# DFR - Stages



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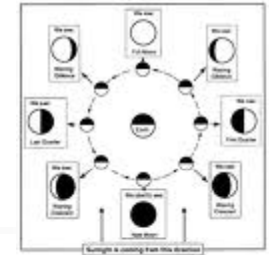
# DFR - *Production*



- *HASS* – Conduct HASS based on the HALT results
- *Eliminating Known Causes of Failures (Fault Avoidance)* - This can be accomplished through screening and burn-in procedures to eliminate weak components before equipment is actually shipped to the customer.



# DFR - Stages



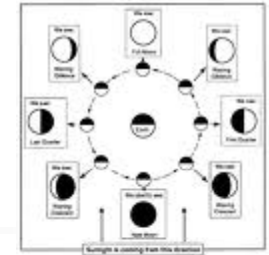
- *Requirements Setting*
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# DFR - *Field Use*



- **FRACAS** – Monitor FRACAS reports to identify anomalies in system reliability

# DFR - Stages



- *Requirements Setting*
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- ***ECO/FCO***

# DFR - *ECO/FCO*

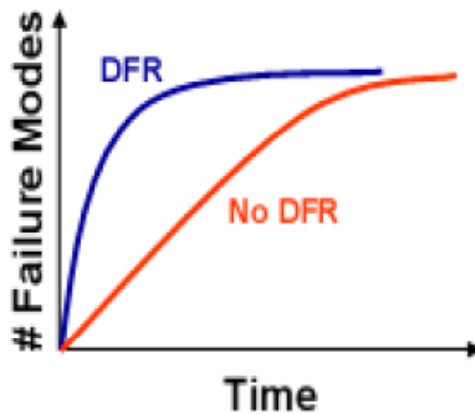


- For each *ECO/FCO*, use the same guidelines above

# DFR Benefits

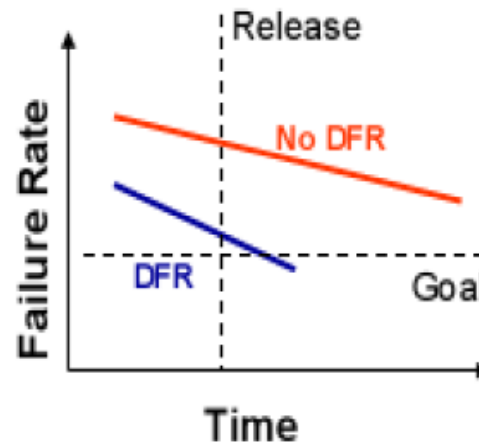


**Failure Mode Identification**  
(Pre-Launch)



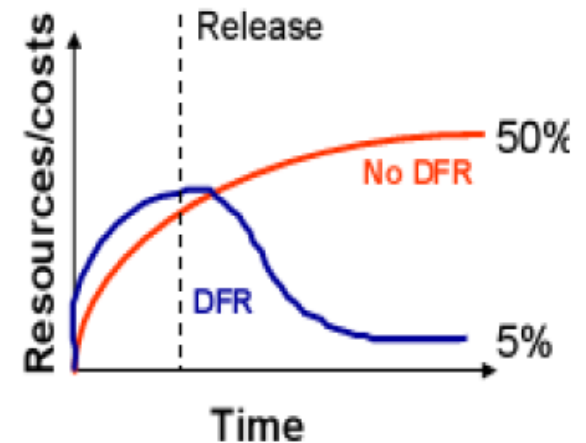
Identify & "eliminate" inherent failure modes before launch. (Minimize Excursions!)

**Failure Rate**



Start with lower "running rate", then aggressively "grow" reliability. (Reduce Warranty Costs)

**Resources/Costs**



Reduce overall costs by employing DFR from the beginning.

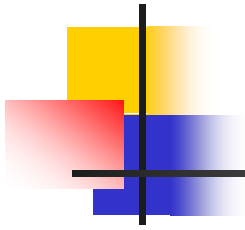


# Summary

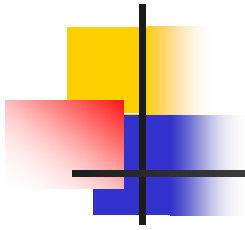


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# Questions?



Thanks for your attention