



ITEM ToolKit

Technical Support Notes

Managing Product Life Cycle in ITEM ToolKit

ITEM Software (USA) Inc.
6789 Quail Hill Parkway
Suite 510
Irvine, California
92603
U.S.A.

+1 (714) 408 7788
sales@itemsoft.com
www.itemsoft.com

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Managing Product Life-Cycle with Item ToolKit

This document explains several approaches you can take to model/track the life-cycle of a product or process using Item ToolKit. There is no “right way” to model a product life-cycle, so ToolKit has been built to be flexible enough to support any approach.

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What is a product life-cycle?

Perhaps a better question to ask is, “What is a product?” Using Item ToolKit, you can model not only electromechanical products, but you can also model processes, software, systems, and other products or processes. You are not limited to just a manufactured product.

TechNote: You could use the Failure Modes (FMECA) module to model a manufacturing process, then transfer it into a Fault Tree for a safety analysis. Or, you could use the Reliability Block Diagram (RBD) module to diagram a high-level view of a medical procedure and use Fault Trees to model and calculate the failure rates for each block in the RBD.

Which modules to use?

Item ToolKit consists of modules to cover all of your Reliability, Availability, Maintainability, Safety, and Risk Assessment requirements. The modules can be used independently, or linked together as needed to accomplish your analysis goals.

Electro-mechanical components failure rate/MTBF prediction modules

- ❑ MIL-HDBK-217
- ❑ Bellcore
- ❑ RDF 2000
- ❑ China 299B
- ❑ NSWC 98/LE1

Failure Mode, Effect, and Criticality Analysis

- ❑ FMECA

Probabilistic and Risk Analysis

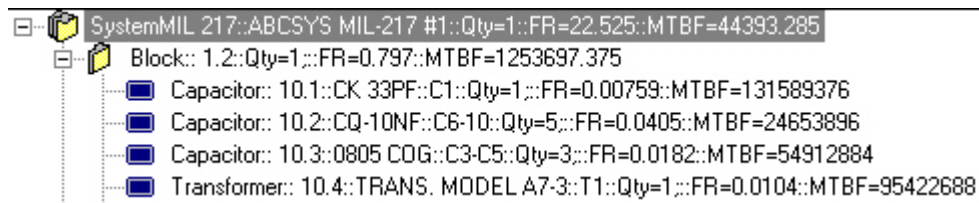
- ❑ Reliability Block Diagram (RBD)
- ❑ Fault Tree
- ❑ Event Tree
- ❑ Markov

Maintenance

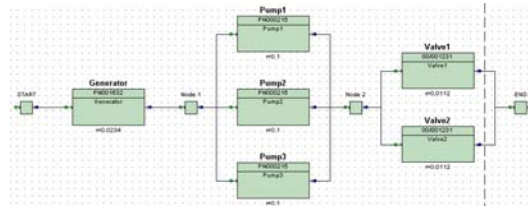
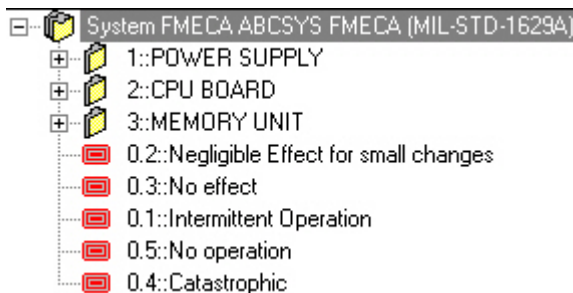
- ❑ MainTain
- ❑ SpareCost

Where to begin?

If you are modeling a manufactured product, you could start modeling via one of the prediction modules (**MIL-217**, **Bellcore**, etc). These modules give you the failure rates and MTBF for electrical and mechanical components that make up your product or system. You can also model redundancy within the prediction modules to get a high level view of “system” availability.



If you do not know the specific components that make up your product, but you do know the major sections or “blocks,” you could start with an **RBD** to model the serial/parallel (redundant) nature of your product. You could also start with a high-level **FMECA** (blocks and system level failure modes only) and later fill in the component failure modes and how they impact the higher levels of your system or process.



Two very common approaches are:

- 1) Model “Rev 1” of your electromechanical product in a prediction module
- 2) Transfer the prediction into FMECA to identify critical failure modes
- 3) Transfer the FMECA into RBD, or Fault Tree for a safety analysis
- 4) Transfer the prediction into MainTain or SpareCost modules to calculate a Mean Time To Repair or optimize sparing levels
- 5) Copy/paste your system to use as a foundation for the subsequent revisions (Rev 2, Rev 3, etc.)

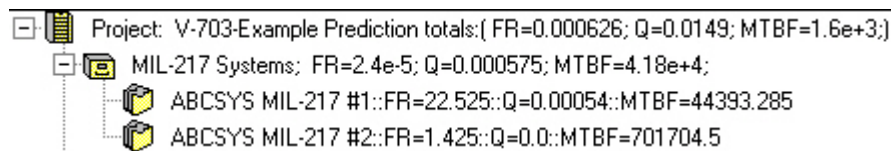
The other is:

- 1) Model “Rev 1” of your product or process at a high level with RBD or FMECA
- 2) As you gain information about your system, edit the RBD or FMECA towards a complete analysis.

System Revisions?

Quite often, no matter which approach you take, you will begin with a first revision and maintain change control by making subsequent revisions. The key is to be able to maintain the history of the systems in case a question arises in the future.

Using ToolKit it is a simple matter to make a “Rev #1” from a base system. Any system within ToolKit can be copied and pasted within the same (or different) project file. After the paste of the copied system, it can be named, “Rev #2,” or some other designator.



Now you have two “identical” copies of the system, and you can begin making the changes to Rev #2. Once those changes are complete, you can easily see the difference in failure rates and other results since they are displayed to you at the top levels of the project windows.

“What if” Scenarios?

Using the power of the copy/paste function for systems within ToolKit, you can create a baseline system, then copy it and use the copy for “what if” investigations. General and Application parameters for components in the copied system can be changed either manually or via the **Edit - Global Parameters** function.

MIL-217 Global Edit

☒ Stress ☒ Temperature ☒ Environment

Stress

☒ Voltage ☒ Current ☒ Power

0.47 0.29 0.61

Temperature

☒ Absolute replacement 45

☐ Incremental addition

Environment

<input type="checkbox"/> Airborne, inhabited, cargo	<input type="checkbox"/> Ground, benign
<input checked="" type="checkbox"/> Airborne, inhab, fighter	<input type="checkbox"/> Ground, fixed
<input type="checkbox"/> Airborne, rotary winged	<input type="checkbox"/> Ground, mobile
<input type="checkbox"/> Airborne, uninhab, cargo	<input type="checkbox"/> Missile, flight
<input type="checkbox"/> Airborne, uninhab, fighter	<input type="checkbox"/> Missile, launch
<input type="checkbox"/> Naval, sheltered	<input type="checkbox"/> Cannon, launch
<input type="checkbox"/> Naval, Unsheltered	<input type="checkbox"/> Space, flight

Apply to

☐ All MIL-217 systems within this project

☒ All blocks + components in selected system

☐ All blocks + components in selected block

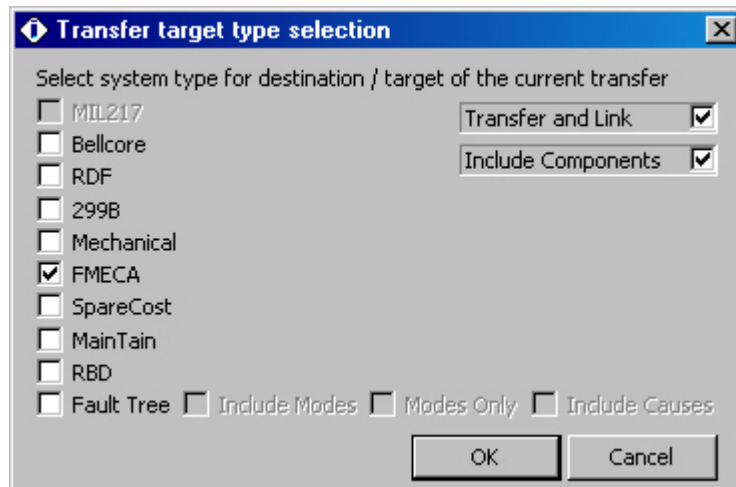
OK Cancel

Each system you define in ToolKit is independent of the others. Any changes you make to one system have no effect on the others: unless you have linked them in some way. (see the following sections) This means that you can edit the copied systems (as many as you wish to make) to investigate different environments, settings, or even configurations of your system, product, or process. Notes can be added to each system explaining the changes or assumptions that were made.

Transferring Systems

Spoken of briefly earlier in this document, you can Transfer any system into any other type of system within ToolKit. (right-click a system) There are a couple of exceptions, but in general you can start with a prediction system (MIL-217, etc), transfer it into a FMECA, or a Fault Tree, or a SpareCost, etc. system. Rather than having to re-build the system in the other module/analysis, the Transfer function enables you to quickly use what you have already built in a different analysis.

Furthermore, you can decide whether to link the transferred systems together, and whether to transfer the components as well. Linking the systems together will pass the failure rates calculated in the first to the second. For example, if you change parameters in a MIL-217 system, and it is linked to a FMECA you are working on, when you re-run your FMECA analysis, the new failure rate results in the MIL-217 are used in the FMECA analysis.



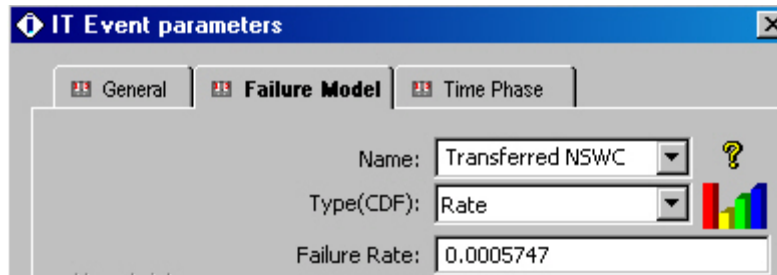
You can choose to transfer the components, or not, in to the new analysis. If you are expecting to perform a high-level FMECA based upon a MIL-217 system, then only transfer the block level into the FMECA. The components will be left behind, but their impact on the block level failure rate will be linked to the FMECA blocks. Now you can perform your high-level FMECA with the MIL-217 feeding the failure rates.

There are many other examples/combinations of Transferred systems. You can even transfer dissimilar prediction standards. For example, you can transfer a Bellcore into a MIL-217 to see how your commercially predicted system stands-up to a military standard. ToolKit makes the translation from one standard to the other for you. Fault Trees can be created from prediction modules, or even a FMECA analysis. The list goes on and on.

Linking

If a full Transfer of a system is too much for what you are trying to accomplish, you can always use the Linking function to solve particular problems.

TechNote: If you are building a Fault Tree and wish to quantify a specific event, you can link that event to any component, block, or entire system elsewhere in the Project to retrieve a failure rate model for that event. This opens up the idea that a single event could actually be representing a failure of an entire system.



Likewise in a FMECA you can link a particular component or block (perhaps representing a step in a process or a required system) to a component, block, or system elsewhere in the Project. Maybe you have modeled a mechanical system in NSWC, and wish to link the failure rate to a component in the FMECA.

As with the Transfer function, Linking has numerous uses and potential combinations. Once you understand how to perform and manage the links, you will discover many different uses for them within ToolKit.

Libraries

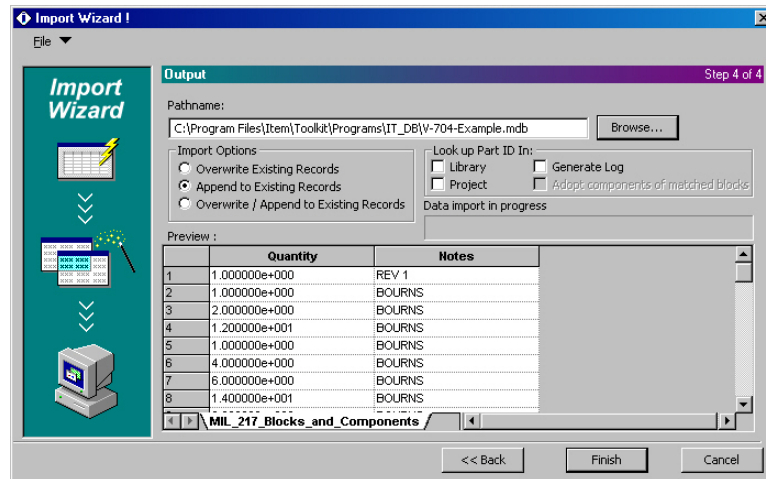
Any ToolKit project can be stored in a common file area on your company network, but most likely you do not want other people to make changes to a baseline project. Rather, you would like to have a “library” of complete systems that others can draw from to begin new analyses, or add to existing.



TechNote: If you have modeled a process in a FMECA, or a mechanical system in NSWC, and you know someone else might want to use your model in the future, then simply copy the system into a ToolKit library file. Someone in the future would be able to open the library and copy/paste all or part of your models into their ToolKit project. They will benefit from the work you have performed already.

Import of Updates

Item ToolKit has a very flexible import function that supports Text, Excel, Access, and other relational database sources of system and component information. Any ToolKit module can be imported into. Depending on the module, you can import as much or as little information as you wish into ToolKit.



After the import, and you have done work on your system, there might be the need to update information in some form or the other. You could manually add/edit the new information into your system in ToolKit, or you could import it directly into ToolKit, appending the new components to the existing system. This method is helpful if you are interacting with vendors who might not have ToolKit.

Conclusion

Following a product life-cycle can be a difficult task due to the wide-ranging sources of information and iterations on the whole or part of a system. You want to have a tool that is specific enough to support accepted standards and approaches to modeling, but you also want a tool that is flexible enough to suit your particular needs. Item ToolKit provides both via our unique user interface, flexibility of input choices, and adherence to accepted world-wide reliability and safety engineering standards.