

Managing Uncertainty in Microelectronic Obsolescence

QinetiQ are approaching the end of a three-year project using Bayesian analysis to manage the uncertainty associated with monitoring and dealing with obsolescence in microelectronics components. They used the AgenaRisk Enterprise Edition to do a cost-benefit analysis of different possible ways of dealing with obsolescence incidents.

Modern vehicles (especially military ones) increasingly use complex electronic components that are often obsolete before the vehicle fleet leaves the production line. There is often a complex relation between individual components, circuit boards, equipment and the overall vehicle. Consider the obsolescence health of all the components on all the boards in a total system.



The requirement for a sensible strategy on handling component obsolescence is therefore becoming a critical concern for fleet owners. The wrong strategy could have catastrophic impacts on whole-life-cost or fleet reliability.

‘The cost of redesigning finished products when components are found to be obsolete can reach £300,000, according to research carried out by Qinetiq for the MoD.’

Richard Wilson, Electronics Weekly

‘On average this can equate to another 200% being added to the bill!’

Alan Baker, Winslow Adaptics

Agena's defence contractor client needed a method for determining obsolescence strategies for arbitrary vehicle architectures. There are many obsolescence management systems for cost-benefit analysis which consider:

- Bridge Buy – Buy enough stock to get the system/board to a scheduled redesign.
- Redesign – Redesign the component to make it cost-effective, maybe using another manufacturer.
- Emulation – Emulate the action of the component via software.
- Last Time Buy – Buy out all the stock that is available for this component and see how far it gets you.
- Alternative/Equivalent Device – Use something else.
- Migrate Technology – Similar to a redesign but often involving the replication of functionality in software.
- Redesign Board – Redesign the board so that the component is not required.

- Redesign System – If the system is based on mostly the same component or no other option is possible then the system may need to be redesigned. This is rare.

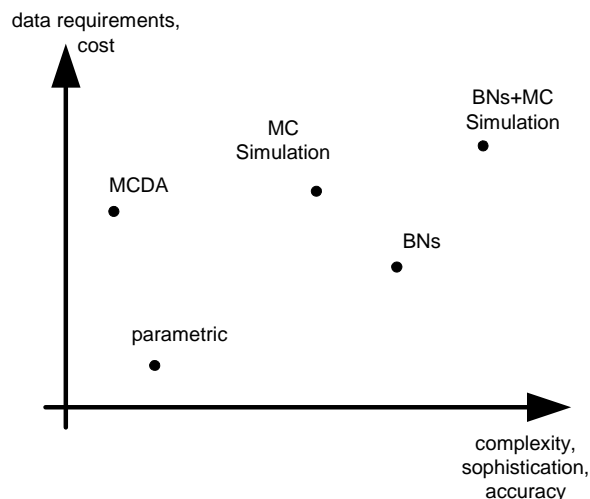
But none of these options considers the uncertainty involved in the analysis. They are limited to dealing with the quoted reliability from the manufacturer and the quoted cost of repair or replacement. No consideration is given to environmental factors.

Another complication is the use of off-the-shelf (COTS) components. COTS components are cheaper to purchase because they are made by many manufacturers in large volumes and are fairly generic. The problem with this is that they are not built to military standards. They are not designed to survive the duration or conditions that military equipment is exposed to.

This is subjective information that is not formalised and that can only be elicited from experts. Most obsolescence management solutions don't take this kind of information into account.

Why Bayesian Networks?

As our client wasn't specifically looking for a Bayesian network solution, Agena conducted an investigation into the cost versus accuracy trade-offs for various simulation methods using our client's model.



The result of this analysis was that Bayesian networks offer the greatest accuracy for the cost of the data entered.

The Solution

The AgenaRisk solution involved automatically generating a class of risk maps directly from a description of the vehicle architecture. The aggregated risk map provides an integrated analysis of cost-benefit options for sub-systems over multiple platforms affected by obsolete components.

The key benefits of using AgenaRisk as the cost-benefit analysis component for this problem are:

- AgenaRisk predicts the optimum number of spares and fleet levels for different usage and attrition profiles.
- AgenaRisk minimises whole-life costs and ranks the most cost-effective options.

- AgenaRisk accounts for the effects of systems integration, COTS and supply chain fragility.
- AgenaRisk identifies the causes of increased cost and poorer quality.
- AgenaRisk considers expert opinion on the environmental conditions of the operating environment.
- AgenaRisk Enterprise Edition is incorporated with the client's component database.