**Journal of Physics: Conference Series, 2012, Volume 364, 012095**

# Obsolescence Risk Assessment Process Best Practice

**F J Romero Rojo[1], R Roy[1] and S Kelly[2]**

[1] Decision Engineering Centre, Manufacturing Department, Cranfield University, Cranfield, Bedfordshire, MK43 0AL, UK.
[2] Ministry of Defence, Kentigern House, 65 Brown Street, Glasgow, G2 8EX, UK.

E-mail: f.romerorojo@cranfield.ac.uk

**Abstract.** A component becomes obsolete when it is no longer available from the original manufacturer to the original specification. In long-lifecycle projects, obsolescence has become a major problem as it prevents the maintenance of the system. This is the reason why obsolescence management is now an essential part of the product support activities in sectors such as defence, aerospace, nuclear and railway; where systems need to be supported for several decades. The obsolescence risk assessment for the Bill of Materials is a paramount activity in order to manage obsolescence proactively and cost-effectively. This is the reason why it was necessary to undertake a benchmarking study to develop best practice in this process. A total of 22 obsolescence experts from 13 different organisations/projects from across UK and USA have participated in this study. Their current processes and experience have been taken into account in the development of the best practice process for obsolescence risk assessment. The key factors that have to be analysed in the risk assessment process for each component in the Bill of Materials are: number of manufacturers, years to end of life, stock available, consumption rate and operational impact criticality. For the very high risk components, a more detailed analysis is required to inform the decisions regarding the most suitable mitigation strategies. On the contrary, for the low risk components, a fully proactive approach is neither appropriate nor cost effective. Therefore, it is advised for these components that obsolescence issues are dealt with reactively. This process has been validated using case studies with several experts from industry and is currently being implemented by the UK Ministry of Defence as technical guidance within the JSP 886 Volume 7 Part 8.13 standards.

## 1. Introduction

Obsolescence risk assessment is essential to manage obsolescence effectively [1]. Although there are existing standards to manage obsolescence, such as the JSP886 Vol. 7 Part 8.13 [2] and IEC 62402:2007 [3], none of them define explicitly a process to assess the risk of obsolescence that can be systematically used by industry. This paper presents the best practice in obsolescence risk assessment, based on a benchmarking study carried out across Joint Obsolescence Management Working Group (JOMWG) members from ten different organisations/projects in UK, as well as attendees of the Diminishing Manufacturing Sources and Material Shortages (DMSMS) and Standardization 2011 conference in USA, such as Defense Logistics Agency (DLA), NAVSEA and ARINC.

The existing standards for Obsolescence Management (JSP886 Vol. 7 Part 8.13 [2] and IEC 62402:2007 [3]) suggest the use of the following criteria for Obsolescence Risk Assessment: cost, impact and probability. However, none of these terms are explicitly defined in those documents. The benchmarking study across different organisations has demonstrated that, although these criteria need

to be taken into account for a detailed obsolescence risk analysis, it is more practical to assess only readily-available parameters for the whole bill of materials (BoM). These are described in Section 3. This paper begins by explaining the research methodology that has been followed. Thereafter, the best practice process for obsolescence risk assessment is described.

## 2. Research Methodology

The research methodology is based on the sequence of activities shown in Figure 1. The first step was to prepare a semi-structured questionnaire that can be applied to capture the current practice on obsolescence risk assessment. Then, the authors liaised with the JOMWG members to arrange interviews in which the questionnaire could be used. After carrying out eight interviews with thirteen JOMWG members, the information collected was analysed using MindMaps. This technique enabled the identification of key parameters and risk factors. These factors were linked with the three key parameters and were prioritised. Two WebEx meetings with two key JOMWG members were carried out to ensure that the list of factors is exhaustive and independent, as well as refining the prioritisation of factors and weights allocation. Three more meetings with DMSMS and Standardization 2011 conference attendees (from DLA, NAVSEA and ARINC) were carried out to ensure that the proposed process is practical to be used in industry and the key factors are taken into account. During a further meeting with another key JOMWG member, the obsolescence risk assessment process was validated and refined. Finally, the feedback received after presenting it at the JOMWG meeting has been incorporated to refine this process.

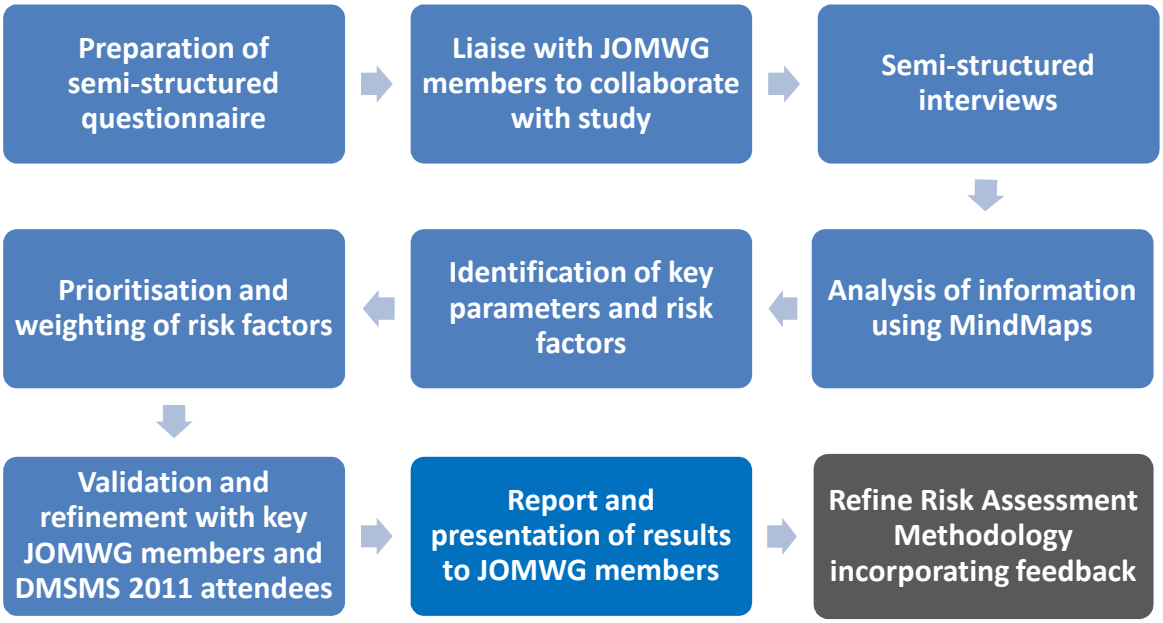


Figure 1. Research Methodology

## 3. Obsolescence Risk Assessment Process

Based on the interviews conducted to understand the current practice across industry, an obsolescence risk assessment process that gathers the best practice has been developed. The top level process flow diagram is shown in Figure 2. This process is described as follows.

Figure 2. Obsolescence Risk Assessment Process Best Practice

### *3.1. Step 1: System Support Plan Assessment*

The first step should be to consider the time for which the system has to be sustained. It is necessary to take into account the planning for mid-life upgrades and also what subsystems are likely to be modified or replaced at this stage. This will allow identifying the period for which each component in the bill of materials (BoM) is required.

### *3.2. Step 2: Resources Planning*

This step in the process is intended to identify the resources available to manage obsolescence that can be allocated to the project:

- People (e.g. obsolescence managers)
- Tools (e.g. obsolescence monitoring tools)
- Budget for obsolescence management

As these resources are limited, the obsolescence risk assessment should enable to decide the key components for which these resources should be used to minimise the impact of obsolescence in the system's performance and sustainment costs.

At this stage it is necessary to align the resources with the strategy selected to meet the contractual terms for obsolescence management.

The activities required for the core steps of the process (3 to 5) are outlined as a flowchart in Figure 3.

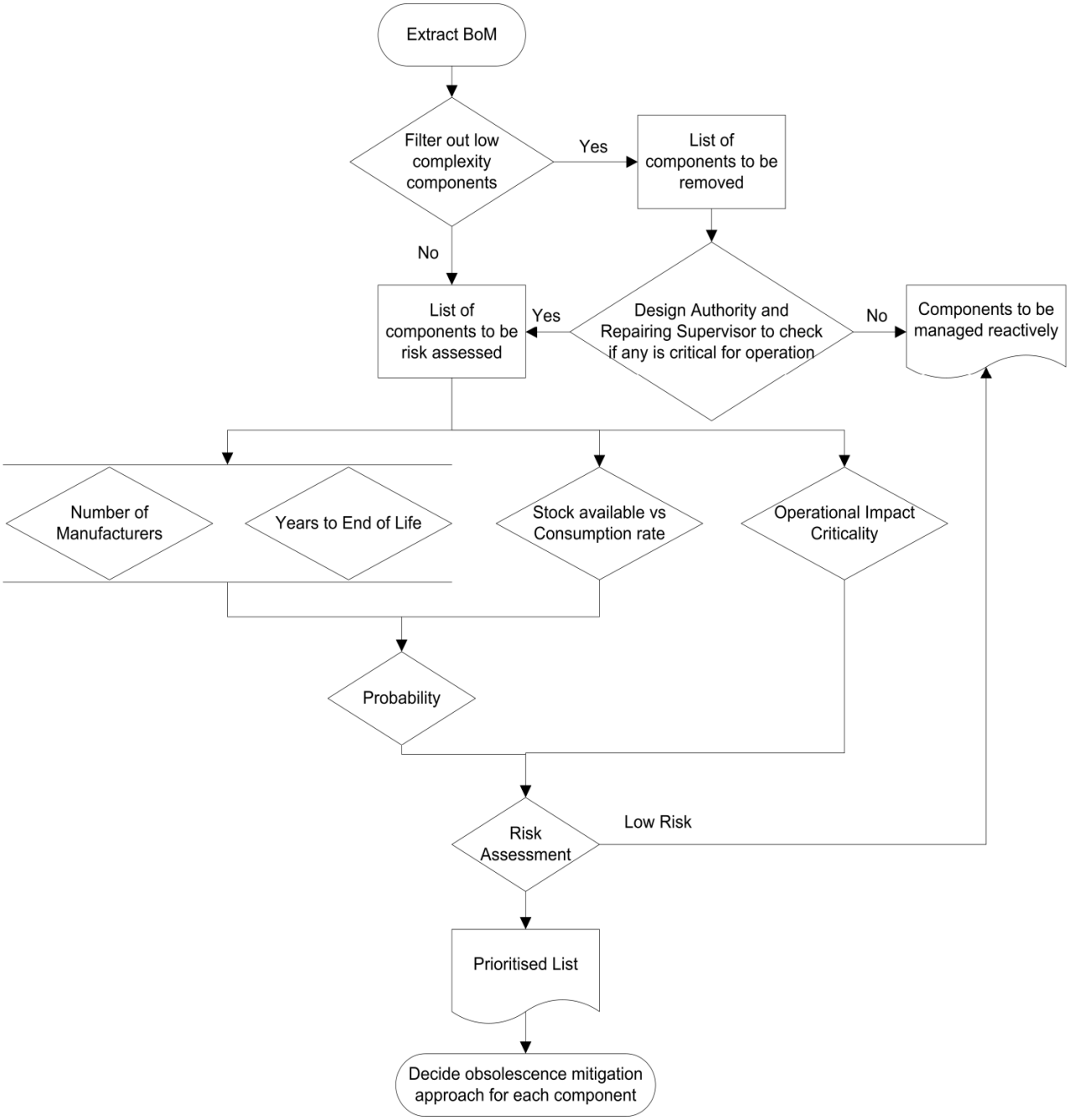


Figure 3. Obsolescence Risk Assessment Process Best Practice Core Steps

### *3.3. Step 3: Extract and Filter Bill of Materials*

The first activity shall be to break down the system or equipment into manageable portions. The level of detail to go down to should be the lowest practical level, which is at the discretion of the Obsolescence Manager. Most obsolescence issues are being experienced at the component level. Therefore, it is suggested that the full bill of materials (BoM) should be extracted from the system to the component level.

From the BoM, the Obsolescence Manager shall filter out the obvious low risk components. This will allow reducing efforts that can be misspent if trying to undertake an exhaustive risk assessment for every component in the BoM. Any components that meet any of the following criteria should be filtered out:

- Standard design (open architecture, standard connectors, modular)
- Passive
- Mechanical
- More than 7 years to end of life (YTEOL)

The list of removed items should be reviewed by the Design Authority, the Repairing Supervisor and/or Program Manager to check if any component is single-sourced or critical for operation. In that case, the component should be brought back to the filtered BoM for further analysis.

*3.4. Step 4: Risk Analysis for each Component*

The obsolescence risk for each component in the filtered BoM should be assessed according to the following parameters:

a. Probability of becoming obsolete and turning into an obsolescence issue. This can be assessed considering the level of stock available for that project, compared with the consumption rate, and either the number of manufacturers available or the number of years to end of life of the component (whichever information is readily available).

   - Number of manufacturers available
     - Single → High
     - Two → Medium
     - More than two → Low
   - Years to End of Life (YTEOL)
     - Less than 2 years → High
     - Between 2 and 5 years → Medium
     - More than 5 years → Low
   - Stock available vs. Consumption rate
     - Low stock & high consumption rate → High [If low component cost and easy to store and short lead time → Medium]
     - Low stock & low consumption rate OR high stock & high consumption rate → Medium
     - High stock & low consumption rate → Low

b. Operational Impact Criticality of the obsolescence issue on the system's functioning and performance. It represents the potential loss of system's availability or capability.
     - Safety critical → High
     - Mission critical → Medium
     - None of the above → Low

The criticality level has to be assessed at either the LRU (Line Replaceable Unit) level or component level, depending on the type of system for which the BoM is been analysed. For example, it should be assessed at the LRU level in a system of systems (e.g. Eurofighter), whereas for a Radar system, it has to be assessed at the component level. Therefore, when the analysis is performed at the LRU level, all the components contained in each LRU should be attributed the level of criticality of the LRU they belong to.

*3.5. Step 5: Components Prioritisation and Mitigation Decisions*

For each component, the number of sources available or YTEOL, and the comparison between stock available and consumption rate will indicate the probability of having an obsolescence issue, as shown in the following risk matrix (Figure 4). In the case that both, the number of sources available and the YTEOL, are readily available, the level of risk for that axis shall be the highest of them.

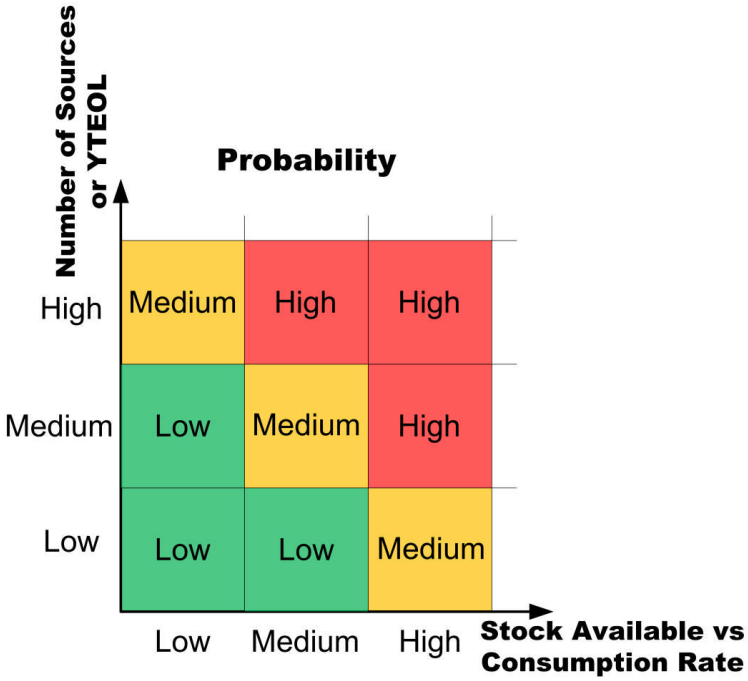


Figure 4. Probability Matrix

The Probability can then be combined with the Operational Impact Criticality to determine the obsolescence risk for that component, using the risk matrix shown in Figure 5.

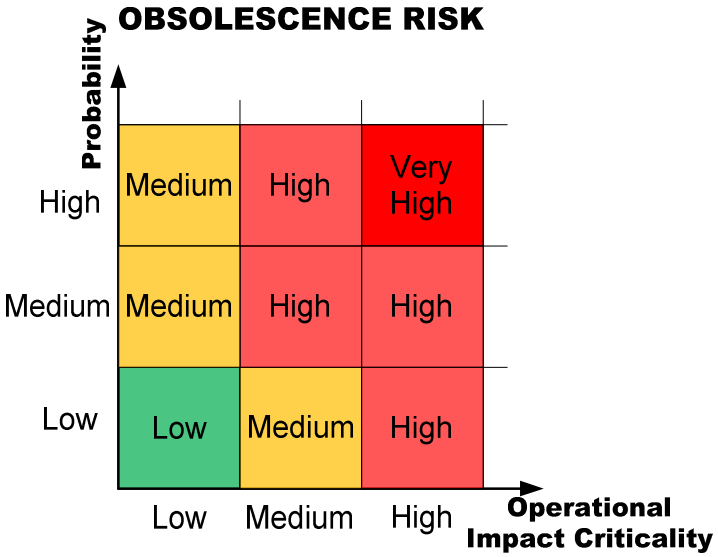


Figure 5. Obsolescence Risk Matrix

Once the process has been followed for all the components in the filtered BoM, they can be ranked based on their obsolescence risk level. The key priority in managing obsolescence is to deploy mitigation strategies to address the Very High risk components. The next priority is to address the High risk components. The Low risk components should be dealt with in a reactive way because it would not be cost-effective to put effort into managing them proactively. The analysis of resources available, carried out in Step 2, will inform the decision that should be made regarding the level of proactiveness to deal with the Medium risk components.

- **Very High Obsolescence Risk**

These components should receive paramount attention, and mitigation strategies should be deployed to reduce the probability and impact that obsolescence issues may have in the system. Examples of mitigation strategies are as follows.

- Design considerations
- Technology transparency
- Partnering agreements with suppliers
- Obsolescence monitoring
- Planned system upgrades
- Risk mitigation buy

The factors indicated in Figure 6 need to be assessed for each component that falls into this category in order to gain a better understanding about the sources of that obsolescence risk and consequently decide the most suitable mitigation strategy. The key criteria are:

- Probability
- Operational impact
- Resolution cost

Each criterion is thoroughly assessed on the basis of the parameters that define it. The relative importance of these factors is quantified by the weights allocated. Once the Obsolescence Manager has analysed those factors for each component, an informed decision can be made on what the most suitable strategy to mitigate that obsolescence risk would be.

For instance, if the analysis shows that there is high probability that a safety critical component will become obsolete and it is required for a long period of time, but the stock remaining is not sufficient to cover that period; it should be considered the possibility of mitigating this risk by purchasing enough stock to cover the remaining period for which that component is required (Risk mitigation buy).

- **High Obsolescence Risk**

The level of proactiveness required to deal with these components is at the discretion of the Obsolescence Manager. Obviously, the level of effort required by these components is lower than the category above. The Obsolescence Manager may decide to apply the analysis indicated in the previous section (Figure 6) to this type of components if there are enough resources available to perform it.

- **Medium Obsolescence Risk**

The components contained in this category should be monitored, so that any obsolescence issue can be managed proactively.

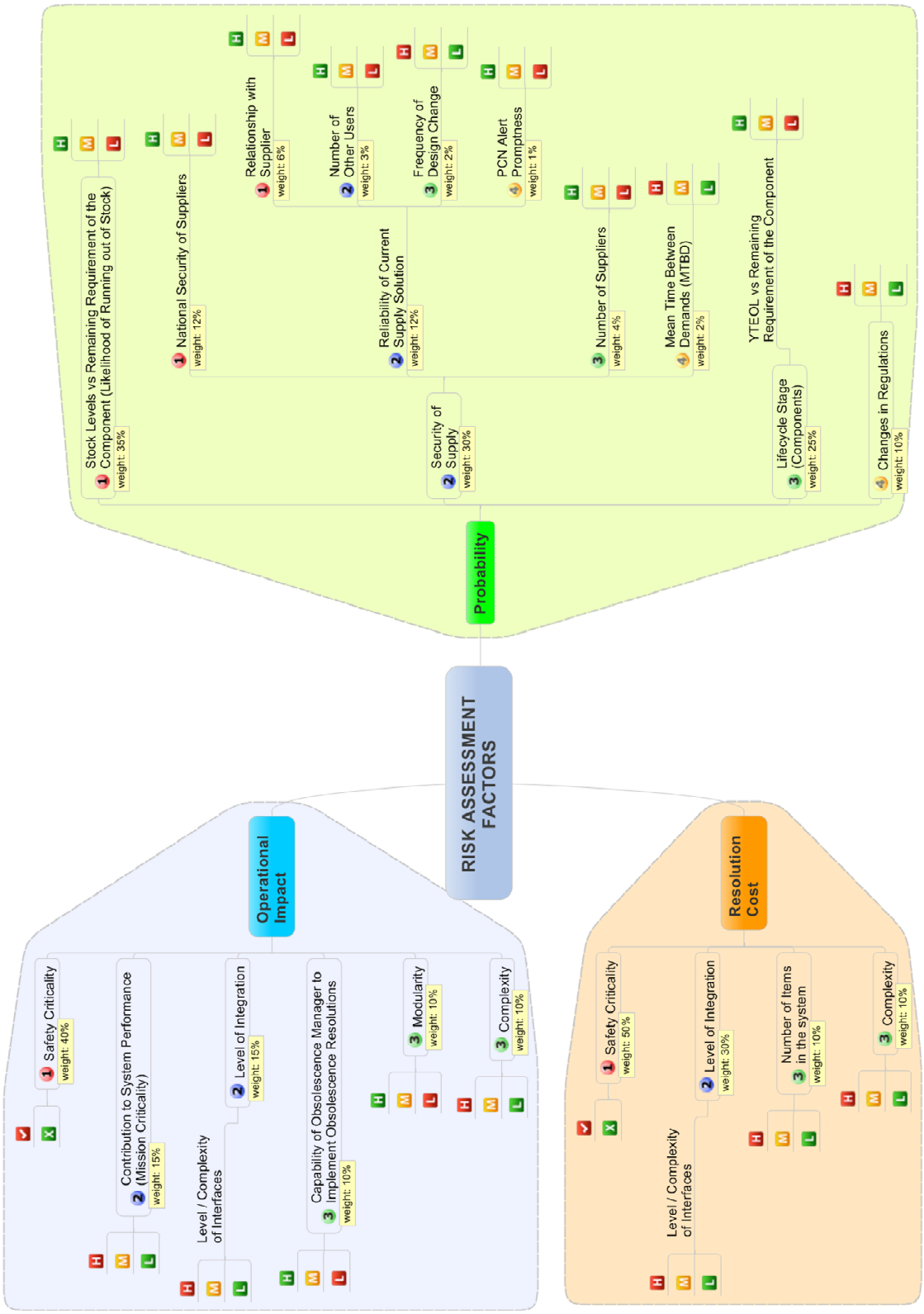
RISK ASSESSMENT FACTORS
Probability
1 Stock Levels vs Remaining Requirement of the Component (Likelihood of Running out of Stock) weight: 35%
1 National Security of Suppliers weight: 12%
1 Relationship with Supplier weight: 6%
2 Number of Other Users weight: 3%
3 Frequency of Design Change weight: 2%
4 PCN Alert Promptness weight: 1%
2 Security of Supply weight: 30%
2 Reliability of Current Supply Solution weight: 12%
3 Number of Suppliers weight: 4%
4 Mean Time Between Demands (MTBD) weight: 2%
3 Lifecycle Stage (Components) weight: 25%
3 YTEOL vs Remaining Requirement of the Component
4 Changes in Regulations weight: 10%
Operational Impact
1 Safety Criticality weight: 40%
2 Contribution to System Performance (Mission Criticality) weight: 15%
2 Level of Integration weight: 15%
3 Capability of Obsolescence Manager to Implement Obsolescence Resolutions weight: 10%
3 Modularity weight: 10%
3 Complexity weight: 10%
Level / Complexity of Interfaces
Resolution Cost
1 Safety Criticality weight: 50%
2 Level of Integration weight: 30%
3 Number of Items in the system weight: 10%
3 Complexity weight: 10%
Level / Complexity of Interfaces

Figure 6 Obsolescence Risk Assessment Factors for Very High Risk Components

- **Low Obsolescence Risk**

For these components, a fully proactive approach is neither appropriate nor cost effective. Therefore, it is advised for these components that obsolescence issues are dealt with reactively.

*3.6. Step 6: Risk Register Update*

Once the decisions about the level of proactiveness have been made and mitigation strategies have been decided for all the components (where applicable), they need to be recorded and implemented. A risk register has to be kept up to date, providing for each component in the BoM the following information:

- Current status (obsolete or not)
- Period for which the component is required
- Risk level
- Details about all the parameters considered in Risk Assessment (e.g. number of manufacturers, YTEOL, operational impact criticality, consumption rate, stock available)
- Mitigation strategies decided (e.g. risk mitigation buy, monitoring, partnering agreements with supplier)
- Resolution approach decided (in the case that it is an obsolescence issue)

*3.7. Step 7: Review*

Periodically, the assessment needs to be reviewed and updated if necessary. It is suggested to review it every six months for projects at the manufacturing stage (manufacturing phase is not completed yet) and on a yearly basis for project at the support stage (manufacturing phase is already completed).

## 4. Concluding Remarks

In long-lifecycle projects, obsolescence has become a major problem as it prevents the maintenance of the system. This is the reason why obsolescence management is now an essential part of the product support activities in sectors such as defence, aerospace, nuclear and railway; where systems need to be supported for several decades. In order to manage obsolescence effectively, it is essential to perform an obsolescence risk assessment for the Bill of Materials. The best practice in obsolescence risk assessment, based on a benchmarking study, has been described in this paper. It addresses the shortcomings of the existing obsolescence management standards regarding this topic.

The key factors that have to be analysed in the obsolescence risk assessment process for each component in the Bill of Materials are: number of manufacturers, years to end of life, stock available, consumption rate and operational impact criticality. For the very high risk components, a more detailed analysis is required to inform the decisions regarding the most suitable mitigation strategies. On the contrary, for the low risk components, a fully proactive approach is neither appropriate nor cost effective. Therefore, it is advised for these components that obsolescence issues are dealt with reactively. This process has been validated using case studies with several experts from industry and is currently being implemented by the UK Ministry of Defence as technical guidance within the JSP 886 Volume 7 Part 8.13 standards.

## 5. References

[1] Romero Rojo F J 2011 *Development of a framework for obsolescence resolution cost estimation.* PhD Thesis, Cranfield University, UK.

[2] JSP 886 - The Defence Logistics Support Chain Manual, Vol 7 - Integrated Logistics Support, Part 8.13 - Obsolescence Management. UK Ministry of Defence policy. Available online at http://www.mod.uk/DefenceInternet/MicroSite/DES/OurPublications/JSP886/ (last accessed on 29th November 2011)
[3] International Obsolescence Management Standard IEC 62402:2007. ISBN: 9780580547355

**Acknowledgments**
The authors would like to thank the following organisations for supporting this research and participating actively: UK MoD DE&S, members of the Joint Obsolescence Management Working Group (JOMWG), DSTL, BAE Systems, Thales Aerospace, Selex Galileo, Ultra Electronics, Component Obsolescence Group (COG), Eurofighter-Typhoon project PT, Linx-Wildcat project PT, Defense Logistics Agency (DLA), NAVSEA and ARINC. They also thank the UK Ministry of Defence for funding the Obsolescence Management Improvement (OMI) research project.

https://dspace.org/

# Obsolescence Risk Assessment Process Best Practice

**Romero Rojo, Francisco Javier; Roy, Rajkumar; Kelly, S.**

**2013-01-22**
Institute of Physics (IOP)
http://dx.doi.org/10.1088/1742-6596/364/1/012095
F.J. Romero Rojo, R Roy and S Kelly. Obsolescence Risk Assessment Process Best Practice. Journal of Physics: Conference Series, 2012, Volume 364, 012095

Downloaded from a DSpace repository. https://dspace.org/