

# MISSION POSSIBLE

Dr David Hillson assesses the benefits and drawbacks of risk analysis.

**F**ormal risk management techniques can be applied to most projects, but this case study illustrates how it was used for a defence programme to assist decision making. The aim is not to reveal specific details of the case study, but to aid understanding of the risk process.

The project was the development of a Management Information System (MIS) to support a first-of-class submarine. The MIS was planned to replace an existing manual system, which used several standalone computerised and paper-based tools. The aim was to reduce the overhead of maintaining management information, to increase efficiency, and enhance flexibility.

The proposed MIS was to perform four functions:

AMS: Management of AR&M data (Availability, Reliability & Maintainability)

CMS: Management of change data (Configuration Management)

DMS: Management of defect data

TLC: Management of Through Life Costing data

Potential problems included:

(a) MIS development was to be subcontracted to a company whose offices were remote from the client and end-user.

(b) Separate development teams were allocated to each function, with one function being further subcontracted to a specialist company.

(c) The development programme contained a high degree of parallelism.

(d) The detailed development strategy was not agreed, with debate between the partners over use of SSADM methodology as opposed to use of CASE tools.

(e) The end-user customer had several levels of management, all of which had different requirements from the MIS, and whose requirements were in some cases mutually exclusive.

(f) Funding was limited, and pressure was being placed to provide maximum functionality for minimum outlay.

(g) The MoD customer also required the final MIS solution to be capable of acting as a prototype for the new IT strategy, known as NLISS (Naval Logistic Information System Strategy).

(h) MIS functionality was required to be delivered in two stages to meet milestones related to the submarine programme but which were "not mandatory".

Given this large degree of uncertainty, a risk assessment was appropriate. The objective was to determine whether the risks inherent in developing a fully automated MIS were so great as to outweigh the potential benefits, and to assess this against the "do nothing" option of retaining the existing manual system.

First there was a comparative qualitative risk assessment of the two options – to develop a full MIS or to retain the existing system. Secondly, a timescale risk analysis on the full MIS development programme would determine realistic and achievable timescales. Lastly, risk reduction measures would be identified for the preferred option, to ensure residual risk was minimised.

The risk assessment phase started with risk identification, conducted using questionnaires and interviews to extract detail on those issues identified.

A checklist ensured complete coverage of potential risk areas.

Having gathered detailed descriptions for

all identified risks, including assessments of probability of occurrence, severity of impact, and trigger conditions, the project team was asked to identify risk reduction measures aimed at either reducing the probability of the risk occurring or minimising its impact. They were also required to identify fallback plans if the risk reduction measures were ineffective.

Data was recorded in a risk database, using the HVR-CSL proprietary product REMIS (Risk Evaluation Management Information System). This was used to produce a Project Risk Register, reporting the find-

ings of the qualitative risk assessment.

Risks were prioritised using a scoring system based on probability (P) and severity of impact (I).

The quantitative risk analysis phase began with development of a risk network based on the agreed project plan, with identified milestones against which project timescale risk could be evaluated. An important step was to map identified risk issues into this risk network, to allow estimates of duration to be conditioned by those risk issues raised during the risk assessment phase. At this point, estimates of duration were obtained from the project team for each activity in the risk network, giving Optimistic (Low), Most Likely, and Pessimistic (High) values.

Monte Carlo simulations were run using the RISK tool, with sensitivity analyses to reveal key drivers in the programme.

## Qualitative risk assessment results

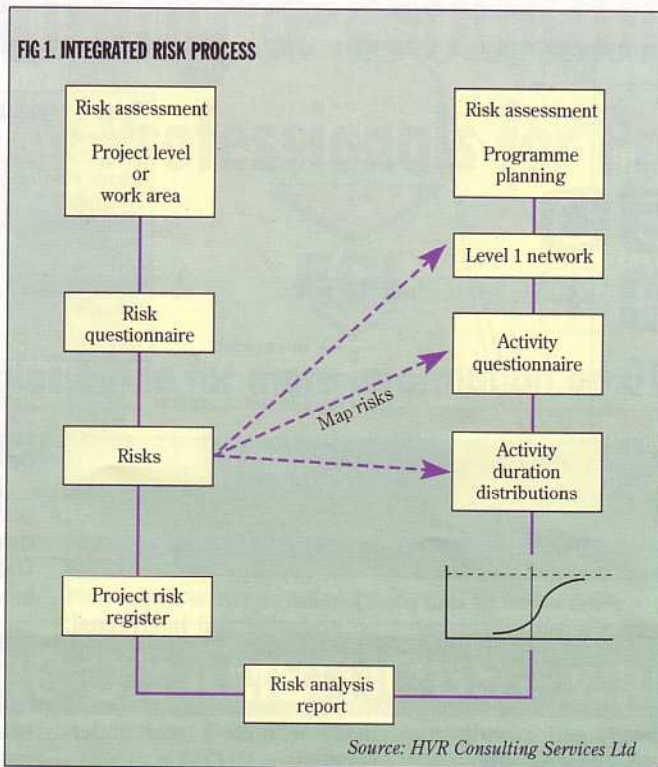
The qualitative risk assessment phase produced the results given in Table 1.

The risk assessment also identified the "Top 10" risk issues threatening the project for each of the two options.

It should be noted that P-I Scores were derived from qualitative assessments of probability and impacts on 5 point scales ranging from "very low" to "very high". Each point on each scale has

**"An assessment of risk exposure is merely a snapshot of the project at the time of the assessment"**

FIG 1. INTEGRATED RISK PROCESS



an associated value in the range 0 to 1, from which the P-I score is obtained as the product of the corresponding values. Each risk issue has three P-I scores, one for each of time, cost and performance.

The qualitative risk assessment indicated that the full MIS development option contained less timescale risk than the "do nothing" option, that there was a similar degree of cost risk, and significant performance risk associated with the "do nothing" option.

It was therefore recommended that the development of a full MIS should proceed. This preliminary conclusion was tested by quantitative risk analysis of the full MIS development option to determine whether the required programme timescales could be achieved.

**Quantitative risk analysis results**

Risk analysis evaluated the likelihood of the Full MIS programme meeting key milestones in the programme, and identified activities likely to become critical during development.

S-curves showing the probability of meeting target dates for the two identified milestones are given in Figure 2. For each milestone, the figure shows three S-curves, representing different states of dependency (full, none and partial). Partial dependency is used to illustrate the most likely outcomes. The results derived from this figure and

Table 1: Qualitative risk assessment results

	Full MIS development	"Do nothing" option
Number of active risks	24	14
Severity of risks (P-I score)		
Time	2.38	2.90
Cost	2.50	2.39
Performance	1.31	3.32
Types of risk	Performance (29%) Complexity (13%) Requirement (13%)	Performance (50%)

subsequent analysis are given in Table 2.

The risk analysis indicated that the Full MIS Development programme contained unacceptable timescale risk. Recommendations made to allow this option to be selected while maintaining a realistic chance of achieving key project objectives included:

- Requesting a programme extension to allow phased delivery of functionality at later times than those originally required.
- Applying a reduced version of SSADM (requiring less work in Stage 3), depending

on use of CASE tools to provide the same degree of assurance and control.

- Consider undertaking pre-contract work in high risk areas, to reduce risk in the development phase.
- Determine whether high criticality activities can be performed more efficiently.

**Risk management phase**

Several key changes were made to the project strategy. This is the point of the process – if results are not used to inform decision making and cause intelligent changes in direction when required, then

the exercise is a waste of time, effort and money.

Planned project start was delayed three months to allow a full reassessment of the full MIS development programme.

A limited amount of pre-contract development was agreed, to be funded by the customer, with the aim of reducing risk in specified areas.

The concept of rapid prototyping was introduced to ensure ultimate acceptability to the customer.

Delivery of the full MIS was decoupled from the previous "firm" milestones within the submarine programme, thus allowing more flexibility in programming the end of the full MIS development phase.

A simpler contracting strategy was devised and agreed. The proposal to reduce the requirement for full Stage 3 SSADM was agreed.

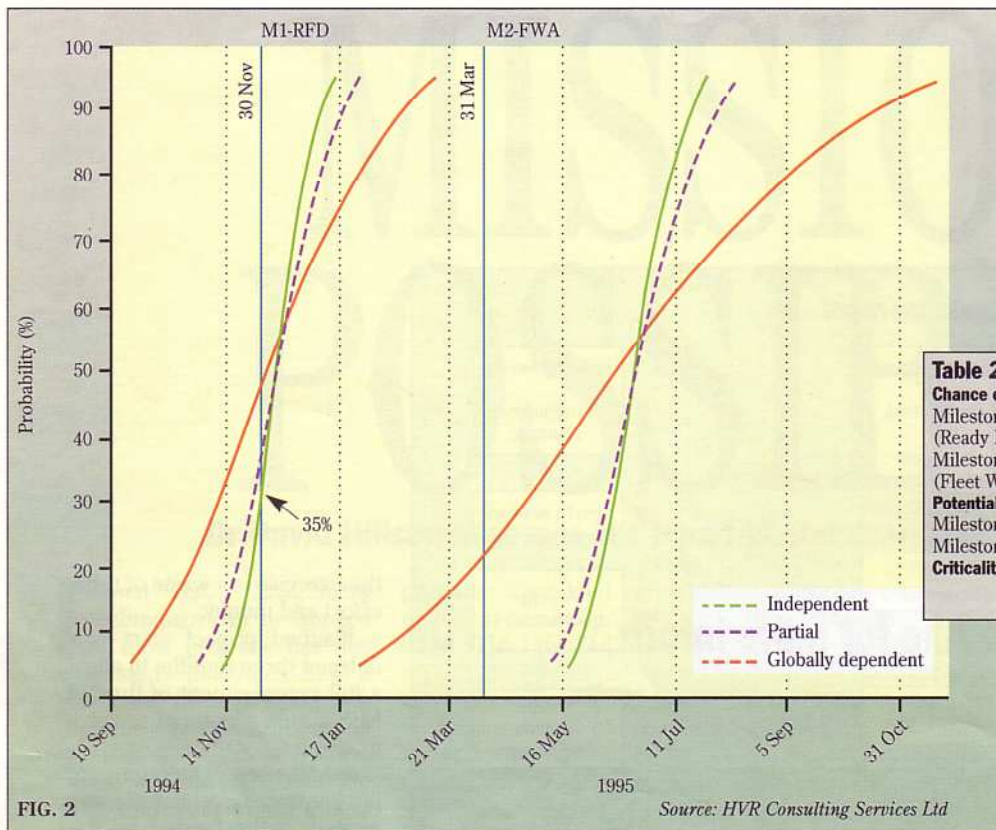
With the implementation of these steps, it was decided that the risk of developing a full MIS would be acceptable, and the contract was finally placed on that basis.

**Evaluation**

There are clear benefits to be gained from formal risk management, but there are also traps.

**Benefits.** Positive effects of implementing a formal and structured risk process can be summarised as "The seven Cs":

1. **Communication.** This is perhaps the major benefit of the



**Table 2 : Quantitative risk analysis results**

Chance of meeting milestones	
Milestone 1 (Ready For Deployment)	35%
Milestone 2 (Fleet Weapons Acceptance)	< 5%
Potential overrun	
Milestone 1	2 months
Milestone 2	4½ months
<b>Criticality</b>	<b>DMS/AMS 90%</b> <b>MS/TLC 10%</b>

FIG. 2

Source: HVR Consulting Services Ltd

risk process. It provides a framework for identifying and discussing project issues in a neutral blame-free environment, with the emphasis on positive action rather than recrimination.

**2. Common understanding.** The risk process brings the whole project team together with a single purpose, and permits members to gain a wider view of the project.

**3. Consensus.** Having established a common understanding of the aims and objectives, the risk process assists the team in agreeing the way to proceed on the key issues.

**4. Consideration of real issues.** Formal risk assessment and analysis can identify issues which can seriously threaten project success. Attention and effort can then be focused on these key issues.

**5. Comparison of alternatives.** All projects contain decision points when alternative courses of action are available. Risk assessment and analysis allows the relative opportunities and threats to be evaluated and compared on a common basis.

**6. Contingency justification.** Many managers apply blanket

contingency levels with no better basis than "gut feel" which can result in over or under-provision. Risk analysis can identify and quantify the amount of contingency required to give an acceptable confidence level.

**7. Credibility.** Use of an independent, objective and unbiased risk process adds weight to the decisions made by the project team, and provides the customer and senior management with confidence.

There are potential dangers in applying the risk process which project managers must guard against:

**GIGO - Garbage In/ Gospel Out.** This has two components: First, results of the risk process will only be as good as the information supplied. Risk practitioners must verify the input to the risk process, and identify and eliminate bias as far as possible. Project objectives should be clearly defined, and assumptions recorded and agreed.

Secondly, output from the formal risk process must still

be evaluated and interpreted. There is a danger that results will be accepted uncritically, leading to decisions being made without a real understanding.

**"Leave it to the experts".** Use of specialist staff can introduce the danger of viewing risk management as the responsibility of the risk specialists, rather than as an integral part of the project management task. The risk process must be owned by the project team.

**"Best before" date.** An assessment of risk exposure is merely a snapshot of the project at the time of the assessment. Circumstances change rapidly and results and recommendations must be acted upon to be effective. The risk report cannot be shelved without quickly becoming useless.

**Measuring effectiveness.** It is difficult to measure and demonstrate whether the risk process is being effective, since it is dealing with issues that are intrinsically uncertain. If risks that were identified fail to materialise, was that due to

**"Results of the risk process will only be as good as the information supplied"**

good risk management, or poor risk identification? If a project is completed under budget, how much of the under-spend can be attributed to the results of risk reduction measures, and what proportion was due to poor initial estimating?

These are questions that risk practitioners are grappling with, as they try to quan-

tify their contribution to project success.

### Defence programmes

The defence industry is leading the field in developing risk management techniques. Defence programmes are inherently high-risk, involving innovative development work, often software-intensive or real-time, usually high cost, and often with stringent safety-critical and security requirements.

As a result, the UK MoD has made risk assessment mandatory on all its projects.

The chief scientific advisor has issued guidelines requiring MoD project managers to assess and manage risk, and funding submissions for Treasury approval must include formal risk assessment.

However, use of formal risk management techniques will benefit all project managers wanting to improve their chances of achieving project objectives. All projects involve a degree of risk, and the successful project manager will be the one who identifies and manages that uncertainty most effectively.

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